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ROYAL COMMISSION
ON
AGRICULTURE IN INDIA

Volume I

Part I

EVIDENCE

OF

Officers serving under the Government of India



CALCUTTA: GOVERNMENT OF INDIA
CENTRAL PUBLICATION BRANCH

1927

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INTERIM REPORT

To

THE KING'S MOST EXCELLENT MAJESTY.

May It Please Your Majesty,

We, the Commissioners appointed to examine and report on the present conditions of agricultural and rural economy in British India, and to make recommendations for the improvement of agriculture and to promote the welfare and prosperity of the rural population ; in particular, to investigate :—(a) the measures now being taken for the promotion of agricultural and veterinary research, experiment, demonstration and education, for the compilation of agricultural statistics, for the introduction of new and better crops and for improvement in agricultural practice, dairy farming and the breeding of stock ; (b) the existing methods of transport and marketing of agricultural produce and stock ; (c) the methods by which agricultural operations are financed and credit afforded to agriculturists ; (d) the main factors affecting rural prosperity and the welfare of the agricultural population ; and to make recommendations ; availing ourselves of Your Majesty's permission to report our proceedings from time to time, desire to submit to Your Majesty the minutes of the evidence which we have taken up to the 18th of October 1926 on the subject of our Inquiry.

All of which we most humbly submit for Your Majesty's most gracious consideration.

(Signed) LINLITHGOW,

Chairman.

(„) H. S. LAWRENCE.

(„) T. H. MIDDLETON.

(„) GANGA RAM.

(„) J. MacKENNA.

(„) H. CALVERT.

(„) GAJAPATI NARAYANA DEO.

(„) N. GANGULEE.

(„) L. K. HYDER.

(„) B. S. KAMAT.

(Signed) J. A. MADAN,

(„) F. W. H. SMITH,

Joint Secretaries.

25th April 1927.

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TERMS OF REFERENCE

Generally,

To examine and report on the present conditions of agriculture and rural economy in British India and to make recommendations for the improvement of agriculture and the promotion of the welfare and prosperity of the rural population ;

In particular to investigate—

- (a) the measures now being taken for the promotion of agricultural and veterinary research, experiment, demonstration and education, for the compilation of agricultural statistics, for the introduction of new and better crops and for improvement in agricultural practice, dairy farming and the breeding of stock ;
- (b) the existing methods of transport and marketing of agricultural produce and stock ;
- (c) the methods by which agricultural operations are financed and credit afforded to agriculturists ;
- (d) the main factors affecting rural prosperity and the welfare of the agricultural population ;

and to make recommendations.

It will not be within the scope of the Commission's duties to make recommendations regarding the existing system of landownership and tenancy or of the assessment of land revenue and irrigation charges, or the existing division of functions between the Government of India and the local Governments. But the Commission shall be at liberty to suggest means whereby the activities of the Governments in India may best be co-ordinated and to indicate directions in which the Government of India may usefully supplement the activities of local Governments.

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QUESTIONNAIRE

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Question.

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3. Demonstration and propaganda.
4. Administration.
5. Finance.
6. Agricultural indebtedness.
7. Fragmentation of holdings.

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QUESTIONNAIRE

PART I

1. Research.

(a) Have you suggestions to advance for the better organisation, administration and financing of—

(i) All research affecting the welfare of the agriculturist, including research into the scientific value of the indigenous theory and traditional methods of agriculture,

(ii) Veterinary research ?

(b) If in cases known to you progress is not being made because of the want of skilled workers, or field or laboratory facilities for study or by reason of any other handicaps, please give particulars. [Suggestions of a general kind should be made under (a) ; answers under this heading should relate to specific subjects. The purpose is to secure a list of the problems met with by scientific investigators in the course of their work which are being held over because of lack of resources or deficient organisation.]

(c) Can you suggest any particular subject for research not at present being investigated to which attention might usefully be turned ?

2. Agricultural Education.

With reference to any form of agricultural education of which you may have experience, please state your views on the following :—

(i) Is the supply of teachers and institutions sufficient ?

(ii) Is there an urgent need for extension of teaching facilities in any district or districts known to you personally ?

(iii) Should teachers in rural areas be drawn from the agricultural classes ?

(iv) Are the attendances at existing institutions as numerous as you would expect in present circumstances ; if not, state reasons. Can you suggest measures likely to stimulate the demand for instruction ?

(v) What are the main incentives which induce lads to study agriculture ?

(vi) Are pupils mainly drawn from the agricultural classes ?

(vii) Are there any modifications in existing courses of study which appear to be called for ; if so, what are they ?

(viii) What are your views upon (a) nature study ; (b) school plots ; (c) school farms ?

(ix) What are the careers of the majority of students who have studied agriculture ?

(x) How can agriculture be made attractive to middle class youths ?

(xi) Are there recent movements for improving the technical knowledge of students who have studied agriculture ?

- (xii) How can adult education in rural tracts be popularised ?
- (xiii) In suggesting any scheme for better educational facilities in rural areas, please give your views for (a) its administration and (b) its finance.

3. Demonstration and Propaganda.

- (a) What are the measures which in your view have been successful in influencing and improving the practice of cultivators ?
- (b) Can you make suggestions for increasing the effectiveness of field demonstrations ?
- (c) Can you suggest methods whereby cultivators may be induced to adopt expert advice ?
- (d) If you are aware of any striking instances of the success or the failure of demonstration and propaganda work, please give particulars and indicate the reasons for success or for failure.

4. Administration.

- (a) Do you wish to suggest means towards the better co-ordination of the activities of the Governments in India or to indicate directions in which the Government of India may usefully supplement the activities of the local Governments ?
- (b) Is it your opinion that the expert scientific knowledge required in the development of agriculture in the different Provinces could be supplied to a greater extent than is the case at present by increasing the scientific staff of the Government of India ? If so, indicate the types of work which would benefit by pooling the services of experts, and suggest how that work should be controlled.

(c) Are you satisfied from the agricultural standpoint with the services afforded by—

- (i) The Agricultural and Veterinary Services,
- (ii) Railways and steamers,
- (iii) Roads,
- (iv) Meteorological Department,
- (v) Posts, and
- (vi) Telegraphs, including wireless ?

If not, please indicate directions in which you think these Services might be improved or extended.

5. Finance.

- (a) What are your views as to the steps that should be taken for the better financing of agricultural operations and for the provision of short and long-term credit to cultivators ?
- (b) Do you wish to suggest means whereby cultivators may be induced to make fuller use of the Government system of *taccavi* ?

6. Agricultural Indebtedness.

- (a) What in your opinion are :—
 - (i) the main causes of borrowing,
 - (ii) the sources of credit, and
 - (iii) the reasons preventing repayment.

(b) What measures in your opinion are necessary for lightening agriculture's burden of debt ? For example, should special measures be taken to deal with rural insolvency, to enforce the application of the Usurious Loans Act, or to facilitate the redemption of mortgages ?

(c) Should measures be taken to restrict or control the credit of cultivators such as limiting the right of mortgage and sale ? Should non-terminable mortgages be prohibited ?

7. Fragmentation of Holdings.

(a) Do you wish to suggest means for reducing the loss in agricultural efficiency attendant upon the excessive subdivision of holdings ?

(b) What are the obstacles in the way of consolidation and how can they be overcome ?

(c) Do you consider legislation to be necessary to deal with minors, widows with life interest, persons legally incapable, alienation and dissentients, and to keep disputes out of the courts ?

PART II

8. Irrigation.

(a) Name any district or districts in which you advocate the adoption of new irrigation schemes, or suggest extensions or improvements in the existing systems or methods of irrigation by—

- (i) Perennial and non-perennial canals,
- (ii) Tanks and ponds,
- (iii) Wells.

What are the obstacles in your district or Province to the extension of irrigation by each of the above methods ?

(b) Are you satisfied with the existing methods of distributing canal water to cultivators ? Describe the methods that have been employed to prevent wastage of water by evaporation and by absorption in the soil. What form of outlet for distribution to cultivators at the tail end do you regard as the most equitable and economical ? Have these methods and devices been successful, or do you wish to suggest improvements ?

(N.B.—Irrigation charges are *not* within the terms of reference of the Commission, and should not be commented upon.)

9. Soils.

(a) Have you suggestions to make—

- (i) for the improvement of soils, whether by drainage or other means, not dealt with under other headings in this questionnaire.
- (ii) for the reclamation of Alkali (Usar) or other uncultivable land,
- (iii) for the prevention of the erosion of the surface soil by flood water ?

(b) Can you give instances of soils known to you which, within your recollection, have—

- (i) undergone marked improvement,
- (ii) suffered marked deterioration ?

If so, please give full particulars.

(c) What measures should Government take to encourage the reclamation of areas of cultivable land which have gone out of cultivation ?

10. Fertilisers.

(a) In your opinion, could greater use be profitably made of natural manures or artificial fertilisers ? If so, please indicate the directions in which you think improvement possible.

(b) Can you suggest measures to prevent the fraudulent adulteration of fertilisers ?

(c) What methods would you employ to popularise new and improved fertilisers ?

(d) Mention any localities known to you in which a considerable increase in the use of manures has recently taken place.

(e) Has effect of manuring with phosphates, nitrates, sulphate of ammonia, and potash manures been sufficiently investigated ? If so, what is the result of such investigation ?

(f) What methods would you employ to discourage the practice of using cowdung as fuel ?

11. Crops.

(a) Please give your views on—

- (i) the improvement of existing crops,
- (ii) the introduction of new crops including fodder crops,
- (iii) the distribution of seeds,
- (iv) the prevention of damage by wild animals.

(b) Can you suggest any heavy yielding food crops in replacement of the present crops ?

(c) Any successful efforts in improving crops or substituting more profitable crops which have come under your own observation should be mentioned.

12. Cultivation.

Can you suggest improvements in—

- (i) the existing system of tillage, or
- (ii) the customary rotations or mixtures of the more important crops ?

13. Crop Protection, Internal and External.

Please give your views on—

- (i) The efficacy and sufficiency of existing measures for protection of crops from external infection, pests and diseases.
- (ii) The desirability of adopting internal measures against infection.

14. Implements.

(a) Have you any suggestion for the improvement of existing, or the introduction of new, agricultural implements and machinery ?

(b) What steps do you think may usefully be taken to hasten the adoption by the cultivator of improved implements ?

(c) Are there any difficulties which manufacturers have to contend with in the production of agricultural implements or their distribution for sale throughout the country? If so, can you suggest means by which these difficulties may be removed?

PART III

15. Veterinary.

(a) Should the Civil Veterinary Department be under the Director of Agriculture or should it be independent?

(b) (i) Are dispensaries under the control of Local (District) Boards? Does this system work well?

(ii) Is the need for expansion being adequately met?

(iii) Would you advocate the transfer of control to Provincial authority?

(c) (i) Do agriculturists make full use of the veterinary dispensaries? If not, can you suggest improvements to remedy this?

(ii) Is full use made of touring dispensaries?

(d) What are the obstacles met with in dealing with contagious diseases? Do you advocate legislation dealing with notification, segregation, disposal of diseased carcasses, compulsory inoculation of contacts and prohibition of the movement of animals exposed to infection? Failing legislation, can you suggest other means of improving existing conditions?

(e) Is there any difficulty in securing sufficient serum to meet the demand?

(f) What are the obstacles in the way of popularising preventive inoculation? Is any fee charged, and, if so, does this act as a deterrent?

(g) Do you consider that the provision of further facilities for research into animal disease is desirable?

If so, do you advocate that such further facilities should take the form of—

(i) an extension of the Muktesar Institute, or

(ii) the setting up, or extension of, Provincial Veterinary Research Institutions?

(h) Do you recommend that special investigations should be conducted by—

(i) officers of the Muktesar Institute, or

(ii) research officers in the Provinces?

(i) Do you recommend the appointment of a Superior Veterinary Officer with the Government of India? What advantages do you expect would result from such an appointment?

16. Animal Husbandry.

(a) Do you wish to make suggestions for—

(i) improving the breeds of livestock,

(ii) the betterment of the dairying industry,

(iii) improving existing practice in animal husbandry?

(b) Comment on the following as causes of injury to cattle in your district—

- (i) Overstocking of common pastures,
- (ii) Absence of enclosed pastures, such as grass borders in tilled fields,
- (iii) Insufficiency of dry fodder such as the straw of cereals or the stems and leaves of pulses,
- (iv) Absence of green fodders in dry seasons,
- (v) Absence of mineral constituents in fodder and feeding stuffs.

(c) Please mention the months of the year in which fodder shortage is most marked in your district. For how many weeks does scarcity of fodder usually exist? After this period of scarcity ends how many weeks elapse before young growing cattle begin to thrive?

(d) Can you suggest any practicable methods of improving or supplementing the fodder supply that would be applicable to your district?

(e) How can landowners be induced to take a keener practical interest in these matters?

PART IV

17. Agricultural Industries.

(a) Can you give any estimate of the number of days of work done by an average cultivator on his holding during the year? What does he do in the slack season?

(b) Can you suggest means for encouraging the adoption of subsidiary industries? Can you suggest any new subsidiary industries to occupy the spare time of the family which could be established with Government aid?

(c) What are the obstacles in the way of expansion of such industries as beekeeping, poultry rearing, fruit growing, sericulture, pisciculture, lac culture, rope making, basket making, etc.?

(d) Do you think that Government should do more to establish industries connected with the preparation of agricultural produce for consumption, such as oil pressing, sugar making, cotton ginning, rice hulling, utilisation of wheat straw for card-board, utilisation of cotton seed for felt, fodder, oil and fuel, utilisation of rice straw for paper, etc.?

(e) Could subsidiary employment be found by encouraging industrial concerns to move to rural areas? Can you suggest methods?

(f) Do you recommend a more intensive study of each rural industry in its technical, commercial and financial aspects, with a view to, among other things, introduction of improved tools and appliances?

(g) Can you suggest any other measures which might lead to greater rural employment?

(h) Can you suggest means whereby the people could be induced to devote their spare time to improving the health conditions of their own environment?

18. Agricultural Labour.

(a) What measures, if any, should be taken to attract agricultural labour from areas in which there is a surplus to—

(i) areas under cultivation in which there is a shortage of such labour ?
and

(ii) areas in which large tracts of cultivable land remain uncultivated ?

Please distinguish between suggestions designed to relieve seasonal unemployment and proposals for the permanent migration of agricultural population.

(b) If there is any shortage of agricultural labour in your Province, what are the causes thereof and how could they be removed ?

(c) Can you suggest measures designed to facilitate the occupation and development, by surplus agricultural labour, of areas not at present under cultivation ?

19. Forests.

(a) Do you consider that forest lands as such are at present being put to their fullest use for agricultural purposes ? For instance, are grazing facilities granted to the extent compatible with the proper preservation of forest areas ? If not, state the changes or developments in current practice which you consider advisable.

(b) Can you suggest means whereby the supply of firewood and fodder in rural areas may be increased ?

(c) Has deterioration of forests led to soil erosion ? What remedies would you suggest for erosion and damage from floods ?

(d) Can you indicate any methods by which supply of moisture in the soil, the rainfall and supply of canal water can be increased and regulated by afforestation or by the increased protection of forests so as to benefit agriculture ? Would the same methods be useful in preventing the destruction by erosion of agricultural land ?

(e) Is there an opening for schemes of afforestation in the neighbourhood of villages ?

(f) Are forests suffering deterioration from excessive grazing ? Is soil erosion being thereby facilitated ? Suggest remedies.

20. Marketing.

(a) Do you consider existing market facilities to be satisfactory ? Please specify and criticise the markets to which you refer, and make suggestions for their improvement.

(b) Are you satisfied with the existing system of marketing and distribution ? If not, please indicate the produce to which you refer and describe and criticise in detail the channels of marketing and distribution from the producer to the consumer in India (or exporter in the case of produce exported overseas). State the services rendered by each intermediary and whether such intermediary acts in the capacity of merchant or commission agent, and comment upon the efficiency of these services and the margins upon which such intermediaries operate. Please describe

the method by which each transaction is financed, or in the case of barter, by which an exchange is effected.

(c) Do you wish to suggest steps whereby the quality, purity, grading or packing of agricultural produce may be improved, distinguishing where possible between produce destined for—

(i) Indian markets ?

(ii) Export markets ?

(d) Do you think that more effective steps might be taken to place at the disposal of cultivators, merchants and traders information as to market conditions, whether Indian or overseas ; crop returns ; complaints as to Indian produce from wheresoever originating ; and agricultural and marketing news in general ?

21. Tariffs and Sea Freights.

Do existing (a) customs duties, both import and export, and (b) sea freights adversely affect the prosperity of the Indian cultivator ? If so, have you any recommendations to make ?

22. Co-operation.

(a) What steps do you think should be taken to encourage the growth of the co-operative movement—

(i) by Government,

(ii) by non-official agencies ?

(b) Have you any observations to make upon—

(i) Credit societies ;

(ii) Purchase societies ;

(iii) Societies formed for the sale of produce or stock ;

(iv) Societies for effecting improvements—*e.g.*, the digging of wells and the construction of bunds, walls and fences, or the planting of hedges ;

(v) Societies formed for the aggregation of fragmented holdings and their redistribution in plots of reasonable size ;

(vi) Societies for the co-operative use of agricultural machinery ;

(vii) Societies for joint farming ;

(viii) Cattle breeding societies ;

(ix) Societies formed for any purpose connected with agriculture or with the betterment of village life, but not specified above ?

(c) Where co-operative schemes for joint improvement, such as co-operative irrigation or co-operative fencing or a co-operative consolidation of holdings scheme, cannot be given effect to owing to the unwillingness of a small minority to join, do you think legislation should be introduced in order to compel such persons to join for the common benefit of all ?

(d) Do you consider that those societies of which you have personal knowledge have, in the main, achieved their object ?

23. General Education.

(a) Do you wish to make observations upon existing systems of education in their bearing upon the agricultural efficiency of the people ? If you make suggestions, please distinguish, as far as possible, between—

- (i) Higher or collegiate,
- (ii) Middle school, and
- (iii) Elementary school education.

(b) (i) Can you suggest any methods whereby rural education may improve the ability and culture of agriculturists of all grades while retaining their interest in the land ?

(ii) What is your experience of compulsory education in rural areas ?

(iii) What is the explanation of the small proportion of boys in rural primary schools who pass through the fourth class ?

24. Attracting Capital.

(a) What steps are necessary in order to induce a larger number of men of capital and enterprise to take to agriculture ?

(b) What are the factors tending to discourage owners of agricultural land from carrying out improvements ?

25. Welfare of Rural Population.

(a) Outside the subjects enumerated above, have you any suggestions to offer for improving hygiene in rural areas and for the promotion of the general well-being and prosperity of the rural population ?

(b) Are you, for instance, in favour of Government conducting economic surveys in typical villages with a view to ascertaining the economic position of the cultivators ? If so, what, in your opinion, should be the scope and methods of such enquiries ?

(c) If you have carried out anything in the nature of such intensive enquiry, please state the broad conclusions which you reached.

26 Statistics.

(a) Do you wish to make suggestions for the extension or improvement of the existing methods of—

- (i) ascertaining areas under cultivation and crops ;
- (ii) estimating the yield of agricultural produce ;
- (iii) enumerating livestock and implements ;
- (iv) collecting information on land tenure, the incidence of land revenue and the size of the agricultural population ;
- (v) arranging and publishing agricultural statistics ?

(b) Have you any other suggestions to make under this heading ?

MINUTES OF EVIDENCE

TAKEN BEFORE THE

ROYAL COMMISSION ON AGRICULTURE.

Tuesday, October 12th, 1926.

SIMLA.

PRESENT :

The MARQUESS OF LINLITHGOW, D.L. (*Chairman*).

Sir HENRY STAVELEY LAWRENCE,
K.C.S.I., I.C.S.

Sir THOMAS MIDDLETON, K.B.E.,
C.B.

Rai Bahadur Sir GANGA RAM, Kt.,
C.I.E., M.V.O.

Sir JAMES MACKENNA, Kt., C.I.E.,
I.C.S.

Mr. H. CALVERT, C.I.E., I.C.S.

Raja Sri KRISHNA CHANDRA GAJA-
PATI NARAYANA DEO of Parlaki-
medi.

Professor N. GANGULEE.

Dr. L. K. HYDER.

Mr. B. S. KAMAT.

Mr. J. A. MADAN, I.C.S. }

Mr. F. W. H. SMITH. } (*Joint Secretaries*).

**Dr. D. CLOUSTON, M.A., D.Sc., C.I.E., Agricultural Adviser
to the Government of India.**

Replies to the Questionnaire.

QUESTION 1.—RESEARCH.—The Government of India should be responsible for the co-ordination of research work in the Provinces; it should supplement, too, the work being done at present by the Agricultural and Veterinary Departments thereof. It is already co-ordinating, to a great extent, the work being done on the improvement of cotton and its efforts in that direction have been most successful. One of the objects in view in constituting the Board of Agriculture in India was to provide an agency by means of which the activities of research workers in the Provinces could be co-ordinated. I have, in one of my memoranda, explained why the Board is unfitted for such a task. It has been handicapped by the fact that it has been given no funds and no executive powers. As an advisory body, on the other hand, it has done most useful work. What is required in a Board of Agriculture consti-

tuted on the lines suggested by me in my memorandum on the Scheme for the establishment of an All-India Organisation for the Advancement of Agriculture. This Board should have an Advisory Council and an Executive Committee. The members of the Council should be appointed by the Government of India in consultation with Local Governments and Indian States, and ample funds should be placed at its disposal for expenditure on research projects and other aids to the farming industry. The Agricultural Adviser to the Government of India, the Secretary to the Board, the Director of the Imperial Institute of Veterinary Research, Muktesar, and Heads of Sections of the Imperial Department of Agriculture, should be on the Executive Council. The Agricultural Adviser should be the Chairman of both bodies: the Secretary should be an experienced agricultural officer on a grade of pay not less than that of a Director of Agriculture.

The function of the Advisory Council of the Board would be to consider ways and means of speeding up the development of India's agricultural industry and to make recommendations: the duty of the Executive Committee would be to take action on these recommendations. It would be necessary for the Imperial Department to have in the Provinces a certain number of research stations controlled by its own officers; but these officers would co-operate with the Provincial and State departments concerned and with their local Boards of Agriculture.

Veterinary research.—The Director of the Imperial Institute of Veterinary Research, Muktesar, should be a member both of the Advisory Council and of the Executive Committee of the Board. He would supervise and to some extent control the lines of veterinary research initiated and financed by the Advisory Council of the Board and carried out by the Executive Committee working in co-operation with the veterinary staff of each Province.

To give effect to this scheme it would be necessary to increase the staff of the Pusa and Muktesar Institutes, and to enable the Agricultural Adviser to give more attention to organisation and administration the post of Assistant to the Agricultural Adviser, held in abeyance at present, would have to be filled.

Scientific value of indigenous theory and traditional methods of agriculture.—As every agricultural expert studies the scientific value of indigenous theory and traditional methods of agriculture in so far as they relate to his own job, I doubt whether any further action is necessary.

Finance.—The Government of India should provide from general revenues the money required for the lines of research adumbrated in this scheme. If it cannot possibly do so, it should raise the money by imposing a small export duty on wheat, tobacco, manures, etc., as recommended by Mr. Lindsay in his memorandum and a reserve fund should be built up with a view to providing against periods of financial stringency. The cotton industry, the tea industry and the lac industry have already taxed themselves in order to raise funds for their development. Other allied industries have not done so, because they are not so well organised; it is the duty of Government to come to their rescue.

Progress in every branch of agricultural and veterinary research is being handicapped at present for want of staff and funds. If trained workers and funds were available much could be done to speed up the improvement of such crops as wheat, rice, sugar-cane, tobacco, oilseeds, vegetables, fruits, etc., and to improve our breeds of cattle and sheep. Much could be done, too, in the way of (1) designing, testing and introducing improved agricultural implements, machinery, (2) improving methods of raising water for irrigation, (3) investigating the causes of salinity in soils and methods of conserving moisture, (4) studying the technique involved in the manufacture of unrefined sugar (*gur*) of good quality, (5) improving our poultry, and (6) testing and popularising the use of manures. A certain amount of work is admittedly being done in all these directions; but there is lack of co-ordination. Moreover, the investigators employed are not always qualified to deal effectively with the problems entrusted to them and there is much duplication.

QUESTION 2.—AGRICULTURAL EDUCATION.—*Agricultural Colleges.*—In Bengal, Assam and Bihar and Orissa there is no agricultural college; this is a serious obstacle to progress in agricultural development in these three Provinces. Without a higher teaching institution a provincial department of agriculture cannot effectively bridge the gulf between the researcher and the tiller of the soil, for it cannot effectively train demonstrators for district work, and it cannot train the sons of landowners who believe in agricultural education as a factor of importance in rural development. Each of the three Provinces mentioned above should have its own agricultural college. An agricultural college in Assam might undertake the training both of agriculturists and tea planters.

The main incentives which induce lads to study agriculture at agricultural colleges are (1) the hope of getting Government employment, (2) the scholarships available, (3) the cheapness of the education given, and (4) the comparatively low standard of attainment required for admission. The students who have up to date taken agricultural courses at agricultural colleges have been mainly drawn from non-cultivating classes. The same remarks apply to the students who take post-graduate courses at Pusa and Bangalore.

The technical knowledge of students who have studied agriculture is improved by giving them short courses. At times students keen on their work take courses during the college vacation.

The study of Agricultural Economics at our agricultural colleges has in the past been somewhat neglected; much more attention should be given to this most important subject.

Post-graduate training.—In no Province has adequate provision for post-graduate training in agriculture and veterinary research been made. If adequate provision for post-graduate training cannot be made in India, men of proved ability should be selected and sent home for training at Government expense. Post-graduate courses in agriculture and the sciences allied thereto are being given at the Agricultural Research Institute, Pusa, and the Institute of Animal Husbandry and Dairying, Bangalore; but for want of staff and for other reasons these courses are not of a sufficiently high standard. Moreover, these courses have not as yet attracted students of the calibre and training required.

The standard of training given in High Schools and Arts Colleges, though it is gradually being improved is not as yet entirely satisfactory. Students admitted to agricultural colleges and to post-graduate courses at Pusa are, in consequence, handicapped to some extent from the very start. In this connection, please see Appendix 1.

Rural education.—A perusal of the recommendations of the Board of Agriculture in India will show that agricultural education has been discussed by that Board time and again. As early as 1905 a resolution was passed to the effect that for rural areas a sound system of education based on rural needs was essential. In later years resolutions were passed in which stress was laid on the importance of sympathetic co-operation between the Educational and Agricultural Departments in adapting rural education to rural needs. It must be confessed, however, that as yet little has been done to give effect to these resolutions.

Rural schools.—The village school is fundamental to any scheme of rural regeneration. The syllabus of such schools should have rural bias; it should be framed with the object of inculcating an interest in, and a love of rural life. Such schools should be supplied with suitable school readers written with the object of interesting those who use them in rural life generally; of quickening their intellectual appreciation of plant and animal life, the soil, tillage operations and the return of the seasons with their renewal of life; and with the object in particular of interesting village boys in the steps being taken by Government departments to improve economic conditions in rural areas. I believe that there is a need for the extension of teaching facilities of this kind and that they should be provided at the expense, if necessary, of

purely literary education. If they were provided, more agriculturists would send their sons to school.

Much of the education given in primary and middle schools at present is from the cultivator's point of view worse than useless. It tends to alienate the sympathy of the pupil from the land, and to unfit him for farming as a vocation. Demand for and appreciation of education of this type is, and always will be small, as far as the best cultivating classes are concerned; they want something more practical.

The teacher.—The guidance of young minds to rural ideals depends much more on the personality of the teacher than on furniture and equipment. It is with the teacher that reform of rural education should therefore start. A rural policy should aim, in short, at discovering and developing a "country sense" in teachers; they should be drawn, as far as possible, from agricultural classes and be specially trained. The number of such teachers available in India at present is admittedly small; from top to bottom the Education Department is staffed with men drawn mainly from non-cultivating classes.

Special vs. bias agricultural school.—I have, in a memorandum already submitted, given my opinion regarding the merits of the two systems of agricultural education now under trial in rural schools. Special agricultural schools of the "Loni" type are never likely to be popular; they are very expensive and have not as yet appealed to the people in those Provinces in which they have been tried. Any demand which at present exists for agricultural training of a vocational type could probably be met more effectively by providing special courses at agricultural colleges.

In the Punjab, agriculture has been added to the curriculum of ordinary vernacular middle schools with the object of giving the boys who attend them a bias towards farming as an occupation. This is the most one can hope to do when dealing with mere youngsters. This system has, in my opinion, great possibilities. It is described in detail in the memorandum drawn up for the Commission by the Punjab Government. From my note in Appendix 2 it will be gathered that I had recommended the introduction of a similar system in the Central Provinces 7½ years ago. This scheme was discussed at an Education Conference held at Nagpur. Please see Appendix 3.

(a) *School plots and (b) school farms.*—This is mainly a local question. It is desirable that the school plot should consist of an area of from 3 to 4 acres and that boys should get some training in the use of implements and in growing crops on a field scale. In Provinces where land is dear and difficult to obtain, however, it may not be possible to find the money required for the acquisition of such large areas for each school.

Adult education.—I doubt whether any appreciable demand for adult education of the literary type is likely to arise in the near future. The Department of Agriculture is within limits giving adult education of a very practical, popular and valuable kind; it could do much more but for the fact that the staff and funds at its disposal are inadequate. Its field demonstrations, its lectures illustrated by lantern slides and cinema films, its agricultural associations, agricultural shows, etc., are all of great educative value. They appeal to the bucolic mind in a way in which words can never do. Any money available for adult education could be utilised with advantage in extending and intensifying the work of educating the agriculturists on these lines. Our aim, in short, should be to show the cultivator in the most direct manner possible how to make more money and raise his standard of living: with a view to effecting this it would pay to curtail, if need be, expenditure on less practical forms of education for the time being.

QUESTION 3.—DEMONSTRATION AND PROPAGANDA.—The amount of useful extension work which a department of agriculture can do depends very largely on the value of the results which it achieves by research and experiment; but it depends very largely, too, on how the demonstration and propaganda work of the department is organised. It is of importance that the Director, Deputy Directors and Extra Assistant Directors of Agriculture should be good administrators and organisers and that agricultural assistants working in the districts

should be thoroughly trained as demonstrators. For demonstration work men who have been brought up on the land are best fitted, if they possess at the same time energy, tact and imagination, for they understand the cultivator and sympathise with him in the disabilities under which he labours. I have been particularly struck by the influence gained by certain Deputy Directors of this type over the cultivators of their circles.

The popular bulletin (Appendix 4) is one of the series of bulletins which I brought out in English and the vernaculars when Director of Agriculture in the Central Provinces. It describes how the work of the Department of Agriculture in the Central Provinces was organised with a view to improving, to the greatest extent possible, the practice of the cultivators. In the proceedings of the Board of Agriculture will be found the reports of the sub-committees appointed to consider ways and means of bringing improved methods of agriculture to the notice of cultivators. I was a member of the different sub-committees appointed to go into this question; their reports read along with the bulletin I have referred to (Appendix 4), express my ideas as to how demonstration and propaganda work can be most effectively organised.

It is very important that the whole scheme of operations which come within the ambit of demonstration and propaganda should be drawn up in detail by an officer who is a good agriculturist, who is in sympathy with the cultivator, who possesses imagination and who has made a study of local conditions, including the economic problems, of his Province. Owing to paucity of staff it has not always been possible to find this type of man for the posts of Director and Deputy Director of Agriculture. This I consider has been an obstacle to progress. The various methods of demonstration and propaganda which have proved effective may be described under the following heads:— (1) Experimental, seed, demonstration and cattle-breeding farms managed by Government; (2) demonstration and seed farms managed by private individuals; (3) village to village demonstrations; (4) agricultural shows; (5) ploughing matches; (6) lectures illustrated by lantern slides and cinema films; (7) publications including popular bulletins, books and leaflets on different aspects of agriculture, agricultural education and rural sanitation; (8) circle, tahsīl, district and provincial agricultural association; (9) Co-operative unions for the production and distribution of improved seed; for the purchase, sale and hire of agricultural implements, manures and fungicides, the sale of agricultural produce, the improvement of the dairy industry, etc.

The effectiveness of methods of demonstration and propaganda depends to a great extent on the qualifications of the Deputy Director whose duty it is to apply them. It is difficult to say which of the methods mentioned above have proved most successful; in a well-organised scheme of extension work demonstration, co-operation and propaganda should each play its part.

Demonstration.—Mistakes have been made in the past in recommending methods before they had been thoroughly tested; such mistakes occur only when the agricultural expert in charge of the operations fails to base his methods on the results obtained by research, experiment and a study of economic conditions. An agricultural improvement should be recommended only after it has been thoroughly tested on a Government farm or farms. It should then be demonstrated in the villages and under village conditions; to see is to believe. All the different kinds of Government farms are in a sense demonstration centres; but it is the result obtained in the village demonstration plot and seed farm which “hits the cultivator in the eye,” so to speak, more especially when that demonstration plot or seed farm is controlled by an influential and intelligent landholder who shows the selected crop or other improvement alongside the *deshi* crop or practice. Agricultural shows and ploughing matches fall within the same category; they are organised by the Department assisted by local landholders and the improvement is presented in a concrete form, by men who have themselves incorporated it into their farm practice. Speaking generally mere words do not appeal to the *bacooli* mind of the peasant. He is slow in grasping a point and somewhat suspicious of the intentions of Government officials even. This is not surprising when

we consider the extent to which he is taken advantage of by moneylenders, merchants and others.

Co-operative organisations.—The circle of an average Deputy Director of Agriculture includes as a rule several districts, some thousands of villages and hundreds of thousands of cultivators. With his small staff and limited number of Government farms he is placed at a great disadvantage, until and unless he succeeds in gaining the hearty co-operation of the cultivator in introducing the improvements he recommends: it is, therefore, necessary to work through associations including the leading men of each district. He organises district and tahsil agricultural associations and if his staff is sufficiently large he forms also small circle associations and co-operative unions. The members of these associations and unions propagate and distribute improved seeds, sell manures, fungicides, etc.; sell and hire out agricultural implements, and otherwise co-operate with the department in the beneficent work of rural development. In this way an efficient Deputy Director can recruit thousands of willing non-official workers who practise what they preach and who help to bridge the gulf between the department and the ryot.

Propaganda.—To enthuse this class with something of his own enthusiasm he publishes in the vernaculars, leaflets, popular bulletins and books describing in simple non-technical language the improvements advocated by his department and the results obtained by those who have adopted them. He contributes articles to the Press, too, which are read both by agriculturists and non-agriculturists.

Co-operation with other officials.—The Deputy Director is only one of several officers who are trying to promote the welfare and prosperity of the rural population. He therefore co-operates in every way possible in each district of his circle with the Collector and his staff and with the officers of the Irrigation, Co-operative and Veterinary Departments. He induces the Collector to visit the Government farms in his district, to inspect private farms during his tours, to discuss with agriculturists the improvements recommended by the department, to preside over the meetings of the district agricultural association and to assist generally in developing extension work. He co-operates with the Registrar of Co-operative Credit Societies in organising non-credit societies for the propagation and distribution of seed, for the sale of implements and manures, etc. He advises the Irrigation Department with respect to the duty of water for different crops, methods of applying that water, etc., and co-operates with that department in inducing cultivators to take water from Government canals and tanks. He confers with the officers of the Veterinary Department regarding outbreaks of cattle diseases and cattle-breeding schemes.

To sum up, the measures which have been successful in improving the practice of cultivators and inducing them to accept expert advice are those I have alluded to under the headings "Demonstration, propaganda and co-operation." In the Province which I know best, namely, the Central Provinces, we had some thousands of seed farms each of which served, to some extent, the purpose of a demonstration farm. Our aim was to make each a nucleus of advanced agricultural ideas and practices. The policy laid down was to have in each tahsil (sub-division of a district) a Government farm and to make it the feeder farm for all the private seed farms of the tahsil.

The success of demonstration and propaganda work is largely dependent on the system on which it is based and the soundness of that system is dependent on the qualifications of the men who evolve it. The system evolved in the Central Provinces is, I believe, a fairly sound one; it has certainly stood the test of time. Its success has been due very largely to the fact that the department, by working through the leading landowners and well-to-do cultivators, were able to effect much in the way of introducing improvements, though the staff employed by Government was very small. The improvements introduced filtered down in course of time to the ryot.

The success achieved was due in no small measure to the interest taken by Sir Benjamin Robertson, Sir Frank Sly and Sir Reginald Craddock in the

activities of the department. I should like to lay stress on the value of the influence for good which the Head of a Province can exert in agricultural development. I should like to lay stress, too, on the importance of (1) the closest possible co-operation between the Department of Agriculture and other departments directly connected with the rural development, and (2) keeping the Collector (Head of the district) in touch with the activities of these departments.

Most officials play their several parts in rural development as a matter of duty. To sustain the interest of landholders in such work Government should in a tangible manner show how much it appreciates the services they render. In the Central Provinces, we instituted a system by which every deserving landholder was first given a beautifully designed "*sanad*" which testified to the fact that he had done useful work in his village in promoting agricultural improvements. In the event of his continuing to do good work, he was, after a period of years, given a suitably designed silver medal. But this was not all; in course of time he was presented with a gold medal and recommended for a Government title. These *sanads*, medals and titles were much appreciated for they were presented to the recipients at large public gatherings and by the Governor as a rule. The recipient invariably wore his medals at agricultural shows and on other big occasions.

QUESTION 4.—ADMINISTRATION.—(a) I have already outlined a scheme for the better co-ordination of the activities of the Imperial and Provincial Departments of Agriculture in my reply to question 1. The Government of India should be prepared to finance the scientific and educational work approved by the Advisory Council to be appointed under that scheme. This would include the financing of (1) research and educational work carried out by the Imperial Department of Agriculture and (2) new research schemes started by the Provinces on the advice of the Advisory Council.

(b) Expert scientific knowledge required in the development of agriculture in the different Provinces could be supplied to a greater extent than is being done at present by increasing the scientific staff of the Government of India. I have in replying to question 1, indicated types of work which would benefit by pooling the services of experts, and have indicated how that work should be controlled.

Agriculture is a transferred subject and the Indian Agricultural Service is to be provincialised. The recruitment of Europeans has been stopped and the tendency in some Provinces at least is to stop the recruitment of Indians from Provinces other than their own. The field of selection is thus being narrowed and the standard of efficiency lowered. Owing to financial stringency, moreover, there are many posts in the Indian Agricultural Service being kept vacant at present. All things considered the position is unsatisfactory.

If the scheme outlined in my reply to question 1 were to be given effect to, it would add considerably to the work and responsibilities of the Hon'ble Member in charge of Education, Health and Lands. He is at present responsible for all business connected with the administration of:—

- (i) Education (except as regards Chiefs' Colleges and technical education, the various branches of which are dealt with by the departments which administer the subjects concerned);
- (ii) Oriental languages (except as regards Pushtu, Baluchi and any other frontier language in the North-West Frontier Province);
- (iii) Records;
- (iv) Books and publications (except the appointment of agents for the sale of official publications in India, the United Kingdom and foreign countries);
- (v) Reformatory schools;

Throughout
British India
and in Berar.

- (vi) Archæology and Epigraphy;
- (vii) Arts and Museums;
- (viii) Medical Institutions and the Civil Medical Services exclusive of officers on the political cadre;
- (ix) Medical Research;
- (x) Public Health;
- (xi) Land Revenue (except as regards Jagirs in the North-West Frontier Province and British Baluchistan);
- (xii) Land Surveys;
- (xiii) Land Acquisition and Alienation;
- (xiv) Civil Veterinary Department;
- (xv) Agriculture;
- (xvi) Famine;
- (xvii) Co-operation;
- (xviii) Forests and Arboriculture;
- (xix) Central Agencies for Research or promotion of special studies in connection with (i), (xiv), (xv), (xvi), (xvii) and (xviii) above;
- (xx) Botanical Survey of India;
- (xxi) Zoological Survey;
- (xxii) Food-stuffs;
- (xxiii) Indians overseas and Emigration (except to Egypt, Palestine and Mesopotamia and foreign countries other than Surinam) and Haj pilgrimage;
- (xxiv) Cinchona cultivation and the supply of Quinine;
- (xxv) Imperial Library;
- (xxvi) Local Self-Government in Berar and throughout British India except British Baluchistan and Ajmer-Merwara.

Through out
British India
and in Berar.

It would probably be desirable to relieve him of all business connected with the administration of subjects (i) to (x), (xxi), (xxiii), (xxiv), (xxv) and (xxvi) and to add Meteorology to his portfolio.

(c) To the services rendered by the Railways, the Public Works Department, Shipping Companies, the Meteorological and Posts and Telegraphs Departments, I have referred in commenting upon memoranda already submitted. For want of roads much agricultural produce has to be conveyed to markets by pack animals owned by middlemen. The producer cannot afford to maintain such animals and is therefore obliged to sell his produce at a price which compares most unfavourably with that obtained by the buyer.

For want of bridges great difficulty is experienced in some parts of India in bringing farm produce to market across rivers and streams. The lack of bridges is, in some Provinces, a more serious matter than lack of roads. Where both are good motor transport is, to some extent, taking the place of vehicles drawn by ponies and bullocks—for passenger traffic, and the place of the bullock cart for goods traffic. This is a promising innovation, releasing as it does a certain number of bullocks for farm work.

QUESTION 5.—FINANCE.—(a) Please see my remarks on page 16 of the volume of memoranda dealing with (1) the work being done in the different sections of the Agricultural Research Institute, Pusa, (2) agricultural education, and (3) the co-operative movement in India.

The introduction and extension of co-operative principles constitute the most useful and most hopeful means of dealing with the problem of agricultural credit.

I believe that cultivators would make fuller use of the Government system of *taccavi* if the policy of giving *taccavi* through the Departments of Agriculture and Co-operative Credit were more widely followed. In the Central Provinces, such loans are given to cultivators on a fairly large scale on the recom-

mentation of the Department of Agriculture for the purchase of improved agricultural implements, machinery and improved seed. It is not possible, however, by that means alone to provide that sound and educative system of rural credit which India so badly wants.

QUESTION 6.—AGRICULTURAL INDEBTEDNESS.—The main causes of the present agricultural indebtedness are, I believe (1) the pressure of the population on the soil; (2) the existence of so many uneconomic holdings due to sub-division; (3) the lack of subsidiary means of subsistence; (4) the failure of crops in years of short rainfall and the spirit of fatalism and improvidence bred of insecurity; (5) thriftlessness and extravagance; (6) prosperity which expands credit and encourages borrowing for non-productive purposes; (7) loss of cattle from starvation and disease; (8) the failure of the cultivator to exert himself with a view to making the most of his land; (9) the ill-health of the cultivator at certain seasons of the year, and (10) the inhumanity of money-lenders and the inarticulateness of their debtors.

QUESTION 7.—FRAGMENTATION OF HOLDINGS.—(a) It is very desirable that consolidation of holdings should be effected. In this connection, I should like to draw the attention of the Royal Commission on Agriculture to the following resolution of the Board of Agriculture in India:—"That this meeting of the Board of Agriculture recognises that in many parts of India the extreme and increasing sub-division of the land and scattered character of the holdings together form a very serious impediment to agricultural progress and to the adoption of agricultural improvements, and wishes to suggest that the attention of Local Governments be called to the matter. It recommends that the question be closely investigated and experiments made in each provincial area in consultation with the Registrar of Co-operative Societies with a view to the adoption of such measures as seem best adapted to meet the special local circumstances and to the introduction of such legislation as may be necessary."

This resolution was referred to Local Governments and the replies showed that except in Bombay, where a permissive Bill was to be introduced to enable landholders to prevent the excessive sub-division of agricultural holdings, it was considered inadvisable to take any immediate practical steps to enforce consolidation owing to divergence of opinion, religious sentiments, rigorous laws of inheritance and other circumstances peculiar to different provinces. Since then some progress has been made in the Punjab in consolidating holdings; 174 societies have been formed for this purpose and 10,411 acres have been readjusted, thereby increasing the size of blocks from 0.6 to 3.75 acres.

The difficulties in the way of consolidation are:—

- (1) The cultivators are conservative and very few of them have up-to-date taken much interest in this question.
- (2) In the Central Provinces, the cultivators are, I know, somewhat suspicious of the landowners (*malguzars*). When the *malguzar* tries to effect consolidation, the cultivators suspect that his object is not to benefit them but himself at their expense. There is reason to believe that the *malguzars* who have consolidated their own land including "sir" land have, in some cases, done so at the expense of the cultivators, so the suspicion of the latter is not entirely unjustified.
- (3) Relations between different landholders in the same village are sometimes strained and this, too, is an obstacle to any amicable arrangement for the consolidation of holdings on a voluntary basis.
- (4) There are also legal obstacles in the way of consolidation. In the Central Provinces, for example, the law at present does not provide for the cultivators obtaining a clear and undisputed right in the land they receive in exchange in the process of consolidation.

As pointed out by Mr. Dyer in his note on the consolidation of holdings in Chattisgarh, it is essential that the law should provide for the free transfer

of existing rights, including encumbrances, whatever they may be, which the scheme of consolidation necessitates. At present the Land Records staff has no authority to bring the land records in accordance with the facts, even when all the people concerned are completely satisfied with the transfers effected in consolidation. Mr. Dyer found that in some villages the only objection the people had to consolidation was that, having accomplished it, they had not the protection which is given to them by an authoritative Government record of their rights. It is evident, therefore, that legislation is necessary to secure the people in their rights whether consolidation is done by Government or by the people themselves.

It should be understood that complete consolidation, that is to say, the reduction of each cultivator's holding to one plot of land is not generally possible. Complete consolidation would not be desirable even if it were possible for the reason that a village generally contains soils of different classes, some of which are suitable for *kharif* and some for *rabi* crops. Some of the village area may be irrigable from existing canals, tanks or wells, while some of it may not be irrigable. Moreover, the soil of some of the village fields is comparatively fertile, while that of others is relatively poor. Where the crop-producing value of land is dependent on so many different factors complete consolidation is not therefore a practical proposition. Consolidation, if it is to be done at all, should under these circumstances be done only by blocks with a view to giving each occupier as many different kinds of land as he occupied before redistribution was effected.

In the Gangetic alluvium the soil admittedly varies much less in quality than it does in other parts of India, and the difficulty on consolidation in that tract should therefore be less. The splendid results achieved by Mr. Calvert in the Punjab indicate that the difficulty can by village co-operation be solved in that province at least.

The chief obstacle in the way of consolidation is that a keen desire for it is lacking. Government should, through the co-operative movement, encourage to the utmost voluntary efforts towards consolidation. I believe that a cinema film depicting firstly the disabilities under which the cultivator labours at present as a result of his holding being so scattered, and secondly the practical advantages enjoyed by the cultivator who has a more or less consolidated holding, would appeal very strongly to the average villager, if the picture story were told in just the right way.

Having created a desire for consolidation Government should (1) employ a special staff to work out a scheme for certain selected villages, (2) bring in the necessary legislation to empower the will of the majority to prevail over the opposition of the minority, and (3) remove legal difficulties with a view to securing for the people concerned, rights in the new plots of land allotted to them.

QUESTION 8.—IRRIGATION.—I should like to refer the Royal Commission on Agriculture to the resolutions passed in 1919 by the Board of Agriculture in India on the subject of measures for famine relief. For ready reference, these resolutions are given below:—

- " 12. Each Local Government in any province, where famine conditions can be mitigated by wells, should have an efficient well-boring department under the charge of an Agricultural Engineer."
- " 13. In connection with such a well-boring department as is recommended, the cost of unsuccessful trial borings should not fall on the individual landowners in whose land they are made."
- " 14. A systematic survey of the supplies of underground water which can be tapped by wells or small bores should be undertaken, as soon as possible, in areas where famine conditions can be mitigated by wells. In spite of the recommendations of the Irrigation Commission (paragraph 175), this survey has not been made to anything like the extent that is desirable, and its importance has not been fully appreciated."

- "15. The possibilities of strainer tube-wells should be carefully investigated where there is any likelihood of their being successful."
- "16. Rivers and other sources of water which can be profitably utilised by pumping and other means, in seasons of drought (even if, at other times, their employment is not likely to be profitable) should be surveyed and mapped, and the question as to whether preparations cannot be made *in advance* to utilise these, as fully as possible, as soon as a drought occurs, should be carefully considered."
- "17. The Board desires to emphasise the importance, for prevention of famine, of protective works such as embankments for regulating the run-off of water from land and the checking of erosion, combined in many instances with the afforestation of part of the area."

Paragraph 175 of the Report of the Royal Irrigation Commission referred to in Resolution 14 was as follows:—

"*Trial borings and subsoil water-survey.*—In many places, notwithstanding the aptitude and experience of the people, uncertainty exists as to the suitability of sites for wells and as to the possibility of tapping a permanent source of supply which would not be dependent on mere local percolation. To obviate the failures to find water which are not infrequent especially when, as in a famine year, wells are made in a hurry, detailed and systematic surveys should be made of the subsoil water. Over the greater part of the alluvial tract of Northern India the people have a very good local knowledge of the nature of the substrata and of the subsoil water-supply; all that seems to be required in this tract is to render assistance, where necessary, in making trial borings by providing boring tools and expert workers at a small charge; and to have mapped out, from local enquiries, all tracts in which the construction of temporary wells can be usefully pushed at an early stage of a famine. In Peninsular India also there are few Provinces in which it would not be useful to provide tools at the head-quarters of most divisions and of some districts and even sub-division as well."

I should like to draw the attention of the Commission to Resolution 14 above. Surveys have been made in the Provinces with respect to the possibility of increasing irrigation facilities by constructing canals and tanks, but a systematic survey of the supplies of under-ground which can be tapped by wells or small bores has not been carried out on a large scale in any Province as far as I know.

QUESTION 9.—SOILS.—(a) Much has been done on certain Government farms in India to prevent by means of embankments and drainage channels the scouring and water-logging of the soil; the Pusa system of drainage is well known. Serious loss due to soil erosion has in this way been prevented, hollows levelled up with fine silt, and the cropping power of the land greatly increased. The more enterprising cultivators construct embankments in their villages to prevent erosion; with a view to encouraging this practice *taccavi* loans should be given on a larger scale under the Land Improvement Loans Act. Government should encourage agriculturists to put up for its consideration joint schemes of land improvement. It should lend on easy terms the money required for carrying out approved schemes. The Co-operative Department should also encourage its members to carry out such schemes.

In 1916, the Board of Agriculture passed the following resolution:—
 "The Board recommends that the Government of India be requested to place at the disposal of the Agricultural Department of Bombay an engineer with experience and aptitude for agricultural work whose sole duties will consist in the preparation and execution of schemes of embankments and

drainage adapted to local conditions." It was pointed out "that the appointment of an engineer to advise the ryots in connection with embanking would produce a more marked improvement in the value of the produce than any other way."

No action has, so far as I know, been taken on this resolution.

(b) Examples of the evil consequences which result from want of control of the surface-drainage are abundant in India. They may be seen in almost every village. "Thousands of acres of valuable land on the left bank of the Jumna have been damaged by the formation of a network of ravines; and villages which were at one time surrounded by fertile fields now lie in a network of useless gullies."

(c) In some of the more sparsely populated parts of India, for example, the North of the Central Provinces, there are large areas of good land overrun with *kans* grass (*Saccharum spontaneum*), a persistent weed which, over considerable areas, has taken complete possession of the land. To this aspect of faulty cultivation I have referred in my remarks on pages 4 and 5 of the volume of memoranda on (1) India's Resources in Mineral Fertilisers, (2) the Manure Trade in India, and (3) the Manufacture and Sale of Agricultural Implements and Machinery in India.

QUESTION 10.—FERTILISERS.—(a) and (b) Please see my notes in the volume of memoranda dealing with (1) India's Resources in Mineral Fertilisers, (2) the Manure Trade in India, and (3) the Manufacture and Sale of Agricultural Implements and Machinery in India, and the volume dealing with Forestry and Agriculture in India, etc.

(c) A considerable increase in the use of manures has recently taken place in Madras, Bombay, Bihar and Central Provinces.

(d) and (e) Please see the notes in Appendix 5 and see my remarks on page 2 of the volume of memoranda dealing with Forestry and Agriculture in India, etc.

For want of funds and staff, experiments with fertilisers have not been carried out in this country on anything like the scale and the standard of scientific accuracy attained in more advanced countries. From the results obtained from the experiments already carried out, the indications are that at present prices nitrogenous fertilisers give a handsome profit when applied at the right time to sugar-cane and garden crops. Under favourable conditions they give an economic return when applied to cotton too. Nitrogen is the soil constituent which is deficient in most Indian soils, and as the tendency of late years has been for nitrogen to drop in price, the margin of profit obtained from the use of such fertilisers as sulphate of ammonia and nitrate of soda has tended to rise.

QUESTION 11.—CROPS.—(a) (i) Please see my remarks under "Economic work on Crops" on pages 9 to 12 of the volume of memoranda which deals with (1) the work being done in the different sections of the Agricultural Research Institute, Pusa, (2) agricultural education, and (3) the co-operative movement in India.

(a) (ii) Several promising fodder crops such as *berseem* (Egyptian clover) and *Rhodes* grass have been introduced. The former is now being grown on a large scale in the North-West Frontier Province.

(b) In tracts where facilities for irrigation have been provided, it is often possible to substitute for inferior millets crops such as wheat and rice which give much larger yields.

(c) In parts of India there is much scope for the introduction of new crops such as ground-nut. Good progress in this direction has already been made in Bombay, Burma and the Central Provinces.

In areas brought under irrigation heavy yielding rices have taken the place of early and less productive kinds and new crops, such as sugar-cane and ground-nut, introduced.

Seed distribution.—In plant selection the heterogeneous mixture of varieties having been sorted out by the plant breeder, selected strains of each

variety are tested first in lines, then in plots of 1/10th of an acre or so. The most promising strains are retained for further trial on a larger scale on a Government seed and demonstration farm. On this farm seed of those varieties which satisfy all requirements are propagated and supplied to private seed farms in the villages. The owners of these private farms multiply the seed and sell it to cultivators in their own and neighbouring villages. With a view to ensuring effective control over the seed produced by these private seed farms, we organised Co-operative Seed Unions in the Central Provinces. Each Union included 10 farms of which one was designated the Central Seed Farm. To the latter farm the department supplied pure seed every year, and the produce of this seed was supplied to the other farms of the Union. With a view to keeping the seed pure the Seed Unions in the cotton tract were encouraged to have their own ginning plants and to gin their own *kapas*. By this system of seed propagation and distribution one Agricultural Assistant was able to control a large number of seed farms. He was responsible only for the purity of the seed produced by the Central Seed Farm; the Union was held responsible for the purity of that produced on the branch farms. Other methods of seed propagation and distribution followed in the Central Provinces are described in some detail in the memorandum drawn up by the local Government thereof, and need not be mentioned here.

An article written for the *Agricultural Journal of India* on "Some Foes of the Farmer in the Central Provinces and how to deal with them" will be found in Appendix 6.

QUESTION 12.—CULTIVATION.—In some parts of India very little attention is paid to the rotation of crops. In the cotton tract, for example, cotton is grown year after year on the same land, so long as the price of this staple remains high. In course of time this induces wilt, a disease which takes a heavy toll on the crop. *Tur* suffers in the same way, but from a different wilt, in tracts where little attention is paid to rotation. On the light gravelly soils in some districts inferior millets are grown year after year without a break. In almost all such cases it would pay, I believe, to rotate these crops with a legume such as ground-nut. Its cultivation has been taken up in some Provinces on a large scale within the last two decades: it is grown in rotation with cotton and millets chiefly.

In parts of India, ground-nut is now being grown successfully as a *kharif* crop after which wheat is grown in tracts previously reserved entirely for *rabi*. With early varieties of ground-nut such as small Japanese and Spanish Pea-nut this system of double cropping is possible.

The tillage implements used in India at present are primitive and inefficient; the *deshi nagar* is perhaps the least efficient of all. A number of different types of improved ploughs have been introduced; some of these are not entirely suitable; those that are suitable are generally too dear.

In parts of India, a blade harrow (*bakhar*) is the tillage implement in common use. It cultivates the soil to a depth of about 3 inches only; shallow cultivation has its disadvantages in a country in which the cultivator is so dependent on the rainfall, shallow cultivation, moreover, encourages the growth of weeds. The more enterprising cultivators in some Provinces are beginning to realise this and now plough their land instead of harrowing it with the blade harrow.

Improved harrows have been introduced in some tracts with advantage and have proved most useful in breaking up (1) the clods in ploughed fields and (2) the hard crust formed after irrigation or a heavy rainfall.

The *deshi* hoes used for interculture being inefficient much money is spent on hand weeding: in some localities crops are still sown broadcast and weeding is done entirely by hand. The introduction of cheap and efficient sowing drills and hoes would go far to induce the cultivator to sow his crops in lines and to use improved hoes for weeding.

Sugar-cane and cotton often suffer as a result of water-logging more especially when grown in heavy clayey soils. Sugar-cane is generally grown

on ridges, but as the ridges are nearly always made by hand the cost is high. When not properly ridged sugar-cane suffers from water-logging which induces red rot, a disease which may, in the case of thick varieties, almost wipe out the whole crop. India needs a cheap and efficient ridging plough: such a plough could be used, too, for making surface drains in cotton fields liable to water-logging. The drainage experiments made on the Surat farm in the Bombay Presidency are promising.

The agricultural implement trade in India lacks organisation and that is one of the main obstacles to progress in this, as in other spheres of agricultural development.

Generally speaking, cultivation in India moves in a vicious circle. Inefficient tillage implements result in poor crop returns and a low margin of profit, and this low margin of profit results in the cultivator not being able to purchase the more efficient implements which he so badly requires.

QUESTION 14.—IMPLEMENTS.—(a) Firms interested in the manufacture of agricultural implements should be encouraged to co-operate with the Imperial and Provincial Departments of Agriculture in evolving improved types. Ransomes, Sims and Jefferies have, with the assistance of officers of the department, designed ploughs which are now being used on a large scale in India. This firm unfortunately has lost money by doing so, as the improved types of plough evolved by them are now being manufactured without let or hindrance by firms in this country and at a much lower price. There is, in consequence, but little demand for the English-made article turned out by the inventors. This English firm has, in short, sown but others have reaped.

It would be worth while encouraging enterprising firms in such cases by offering a fixed sum for the best implement of its kind designed to meet certain conditions. If this were done, engineering firms in India could probably be induced to employ specialists for the agricultural side of their business. As far as I know, they do not at present employ trained agricultural engineers.

The views of the Chief Controller of Stores on (1) the standardisation of patterns and designs, (2) the training of engineers and mechanics, (3) inspection of implements with a view to securing a high standard of quality and good workmanship, and (4) the organisation of a central purchasing agency, are worthy of consideration.

(b) Practical demonstrations conducted on a large scale would hasten the adoption by the cultivator of improved implements. In some Provinces short courses are already being given on Government farms in the handling of implements and machinery. These courses should be extended. The holding of large agricultural shows at which agricultural implements and machinery are exhibited and worked gives a great impetus to the demand for the same. In the Central Provinces we ploughed for landholders *kans*-infested land on contract: this, too, certainly helped to create a demand both for improved bullock-drawn ploughs and for motor tractors and motor ploughs.

Government should give *taccavi* loans for the purchase of agricultural implements and machinery on a much larger scale than is being done at present. For agricultural depôts on Government farms there should be permanent advances sanctioned and implements should be purchased and stocked there for sale. The stocking of implements belonging to private firms on consignment account does not, as a rule, work well.

Agricultural associations should be encouraged to start co-operative societies for the sale and hire of implements, and all the implements required for a Province as a whole ordered by a central body representing the different societies. Firms are prepared to give a big discount on large orders.

QUESTION 16.—ANIMAL HUSBANDRY.—(a) Please see the recommendations of the Board of Agriculture in India as given on pages 15 to 24 of the volume of memoranda dealing with (1) the recommendations of the Board of Agriculture in India, and (2) the recommendations of the Indian Economic

Enquiry Committee and Taxation Enquiry Committee, in so far as they relate to agriculture with notes as to the action, if any, taken thereon. These recommendations express my views on the questions discussed.

(b) Please see also my remarks on pages 2 to 5 of the volume of memorandum dealing with the work of (1) the Imperial Institute of Veterinary Research, Muktesar, (2) the Animal Husbandry Section, Bangalore, (3) the Military Farms in India, (4) the Animal Nutrition Section of the Imperial Institute of Animal Husbandry and Dairying, Bangalore, and (5) on the quarantine arrangements for the inspection of animals imported into India. Dairying, if developed, should prove a profitable subsidiary industry for cultivators and for that reason the Imperial Department of Agriculture is concentrating on the improvement of dual-purpose breeds.

(c) Over the greater part of India there is great scarcity of fodder from December till July.

(d) The practicable methods of dealing with the fodder problem are (1) to reduce the large number of useless cattle kept at present, (2) to grow fodder crops such as *jowar* and *berseem*, (3) to stock fodder crops both in the dry state and as silage for use when grazing areas are parched and bare, and to encourage stall-feeding, (4) to introduce dual-purpose breeds with a view to reducing the number of milch animals required, and (5) to restrict, as far as possible, cattle-breeding and rearing by landless *gowalas* and other cattle-owners who are to a great extent parasites on the cultivator.

(e) The systematic improvement of Indian cattle, by the gradual repair of the results of centuries of neglect, is a most formidable undertaking. To effect an appreciable advance in this direction will necessarily take a considerable time, but without the hearty co-operation of our large landowners the task will be well nigh impossible. Landowners are now taking a keener interest in animal husbandry in those Provinces in which an efficient system of demonstration, propaganda and co-operation has been evolved and pure-bred herds of the local breeds have been established by the Department of Agriculture.

The backwardness of animal husbandry and agriculture generally is due in no small measure to the fact that our bigger landowners have done so very little to promote the industry. Some Indian princes take an interest in, and spend much money on, horses and dogs; but to them the steps taken by the Department of Agriculture to improve cattle, crops and other aids to the farming industry have not yet appealed. In the Central Provinces, the landowners, who have co-operated with the department and done so much to develop animal husbandry and agriculture generally, are small landholders who cultivate all or part of their own lands. In the days of non-co-operation when our agricultural shows and other lines of demonstration work were boycotted by landless non-co-operators, these cultivating landowners never failed us.

The department can do much by demonstration and propaganda to stimulate a keener practical interest in animal husbandry. It can establish pedigree herds and organise cattle shows. I have, in my memorandum on the establishment of an All-India Agricultural Organisation, suggested that under the auspices of this All-India body one agricultural show should be held in India every year. At such shows lectures on cattle-breeding and dairying illustrated by lantern slides and cinema films, could be given. The slides and films should depict what is being done in India to improve cattle by better breeding and feeding. They should depict, too, how our fine English breeds have been evolved within the last two centuries. The lecturer would explain these slides and films and lay stress on the fact that these breeds were evolved by English "gentlemen" farmers at their own expense and from material which to start with was not as good as we have in India to-day.

In India we have our depressed classes; we have, too, our depressed industries, and agriculture is unfortunately one of them. How to induce land-

owners to take a keen practical interest in rural regeneration is to my mind a question to which the Royal Commission should give special attention.

It is most desirable that Government should lay more stress on the importance of the work which the Department of Agriculture is doing in India. The opinion of many of our agricultural experts is that in the welter of political controversy our premier industry has not received from Government even, the support it deserves. Many of our most experienced experts left the department during the difficult transition period which followed the advent of the Reforms. The department lost the services of these men unfortunately at the very time when their services were most required; it has lost weight in consequence. Imbued with this idea I drew up for the consideration of the Government of India last year the note which is given in Appendix 7. In forwarding that note I suggested that the Imperial Cattle-breeding Farm at Karnal should be called the Viceroy's Farm and pointed out that it would not be necessary to alter the present arrangements by which the farm is managed and financed by the Government of India. The action recommended in that note is perhaps no longer necessary, in view of the fact that His Excellency the present Viceroy has on his own initiative taken steps to impress on the minds of India's landowning classes (1) the need of developing India's agricultural industry and (2) the dignity of agriculture as a vocation. His Excellency's sincere belief in the dignity of farming as a vocation cannot fail to influence our leading Indian princes, zamindars and other landowners.

His Excellency has already visited the Cattle-breeding Farm at Karnal and is to visit it again next month. His example will, I am convinced, do more to induce our landowners to take a practical interest in animal husbandry than anything the Department of Agriculture could possibly do.

QUESTION 17.—AGRICULTURAL INDUSTRIES.—Please see my remarks in the volume of memoranda dealing with the work of (1) the United Planters' Association of Southern India, (2) the Bihar Planters' Association, (3) the Indian Indigo Association, (4) the Indian Tea Association, (5) Fruit-growing and Poultry-rearing in India, and (6) Bee-keeping, Lac-culture and other possible subsidiary industries for rural areas. I submitted proposals last year to the effect that the Government of India should appoint a Fruit-growing Expert and a Poultry Expert. The Government of India decided to await the recommendations of the Royal Commission on Agriculture before taking action in the matter. The Fruit-growing Expert would tackle also problems relating to market gardening. In the event of the steps now being taken to stimulate interest in dual-purpose breeds of cattle and dairying proving effective, dairying would become a very suitable subsidiary occupation for the cultivators in parts of India. Of all the possible subsidiary industries I consider dairying, fruit growing, market gardening and poultry keeping the most promising.

QUESTION 19.—FORESTS.—(b) and (c) Please see my remarks on page 2 of the volume of memoranda on (1) Forestry and Agriculture in India, (2) the Botanical Survey of India, (3) Irrigation Statistics, (4) Indian Meteorology in relation to Agriculture, (5) Agricultural Statistics, (6) the work of the Posts and Telegraphs Department in rural areas, and (7) Sanitation.

QUESTION 20.—MARKETING.—(a) and (b) I have drawn the attention of Local Governments and Administrations to the importance of this question and anticipate that they will, in replying to the questionnaire, give detailed information on the points raised.

The system under which agricultural produce is marketed varies to some extent from Province to Province; it varies, too, with the economic position and with the intelligence and enterprise of the cultivator. Most kinds of farm produce are delivered to the village trader who, at the same time, is a money-lender as a rule. He despatches the produce to the larger commercial centres for local consumption, or to a sea-port town for export. In recent years the cultivator has been brought into closer touch with markets for agricultural produce and is now in a better position in regard to prices obtain-

able for such produce. Some of the more enterprising landholders, moreover, follow the trend of prices very closely and hold up their produce when they have reason to believe that prices are to rise still further. Some of the larger cotton growers in Berar, for example, keep themselves informed with respect to cotton prices in Bombay and the world's available supply of raw cotton, and at times withhold their cotton from market for a whole year. They have dispensed entirely with the services of local *baniyas* and with great advantage to themselves.

The existing systems of marketing are on the whole bad, but there are exceptions such as the cotton markets of the Central Provinces and Berar. They are bad because there are so many intermediaries between the producer and the consumer and each intermediary makes his honest or dishonest penny. The margins upon which these intermediaries operate are not as a rule unduly high, but there are too many of them to be provided for. Markets like the cotton markets of the Central Provinces and Berar established for the disposal of agricultural produce help to keep the cultivator in touch with actual market conditions and to reduce the number of intermediaries to be supported by the trade.

In some Provinces the Co-operative Department has organised societies of cultivators to sell their produce to the wholesale dealer direct. This system of marketing has, I believe, great possibilities. It ensures a higher standard of honesty and it secures for the producer higher prices. The adoption of such a system makes it possible to improve the quality, purity, grading and packing of agricultural produce.

More effective steps might be taken to place at the disposal of cultivators, merchants and traders information as to market conditions in India and other parts of the world. It should be possible for the Department of Post and Telegraphs to co-operate with the Agricultural and Co-operative Departments in working out a scheme by which such information would be posted up at regular intervals both at important markets and telegraph offices in rural areas.

Much could be done to improve the system of marketing if the improvement of each crop and the marketing of the produce were taken up on the lines adumbrated by me in my reply to question 1. For the improvement of wheat, for example, an All-India Committee constituted on the lines of the Indian Central Cotton Committee should be appointed. That Committee should deal with every aspect of wheat improvement, from the selection and propagation of the best types of seed, to the installation of grain elevators and the improvement of markets.

As a result of the organisation set up in this country by exporting firms the quality of farm produce exported is better than that of the produce used for local consumption. Exporting firms insist on quality and they get it to some extent at least.

QUESTION 21.—TARIFFS AND SEA FREIGHTS.—Protective tariffs affect the cultivator in India, but to what extent it is difficult to tell.

Sea freights, as far as I have been able to ascertain, are not unduly high.

Some countries such as France and Belgium have imposed a protective duty on vegetable oils while they admit oil-seeds free of duty. This encourages the export of Indian oil-seeds but discourages the export of oil. If a much larger proportion of the oil-seeds produced in India could be crushed in the country there would be more cake available for use in rural areas. The cultivator has yet to be taught the value of oil-cakes. He does not realise their value at present, with the result that much of the cake made in the country is exported. This state of affairs could, we believe, be remedied by active demonstration and propaganda, and by providing the cultivator with better credit facilities. In some Provinces Government is already giving *taccavi* loans for the purchase of oil-cakes and other manures; co-operative banks are helping in the same direction, but far too little has yet been done.

QUESTION 22.—CO-OPERATION.—To encourage the growth of the co-operative movement the staff of the Co-operative Department should be considerably

strengthened; great care should be exercised in selecting the Registrars and the men selected should, in the event of proving successful, be allowed to retain their post for at least 10 years.

There should be close co-operation between the Co-operative and Agricultural Departments; the Director of Agriculture and Registrar of Co-operative Societies should be members of the Provincial Board of Agriculture.

Good work has been done in some Provinces by co-operative seed unions. In some Provinces, too, co-operative societies formed for the purchase, sale and hire of agricultural implements have done useful work. I have had some experience of co-operative cattle-breeding societies and have come to the conclusion that there is little hope of such societies being able to effect any marked improvement in the field of animal husbandry. Success in cattle-breeding depends very largely on the personal interest which the owner himself takes in his cattle. Indian cattle-owners do not as yet take much interest in their own herds and are less likely to interest themselves in herds controlled by societies.

The society for *gowalas* started at Telenkheri in Nagpur has been highly successful; but success in this case has been entirely due to the fact that the cattle of the society are housed and fed on a Government farm where breeding is controlled by the Department of Agriculture.

In the Central Provinces the Co-operative Department confined its attention very largely to co-operative credit societies. The Department of Agriculture took the initiative in forming non-credit organisations including seed unions, co-operative shops for the sale and hire of implements, etc.

QUESTION 23.—GENERAL EDUCATION.—Educational movements in India have hardly touched the cultivator of the land. In urban areas the demand for literary education is insistent; the pity is that something more practical could not have been devised for rural areas.

Elementary Education.—My views on the subject of elementary education are given in an article on "Rural Education and Agricultural Development" which was published in Volume 12 of the *Agricultural Journal of India* in 1917. A copy of that article will be found in Appendix 8. A perusal of that article will show that I advocated the teaching of "Nature Study" in school gardens with a view to training intelligence.

Middle Schools.—In the case of rural middle schools I recommended as long ago as 1919 that larger plots of land should be provided and that agriculture should be combined with general education as has since been done in the Punjab.

Collegiate Education.—As very few of the sons of cultivating classes go to High schools or Arts colleges it is somewhat doubtful whether it is worth while providing agricultural courses for these institutions. It would be an advantage, however, if the preliminary training of science students at these institutions could be improved. Students admitted to provincial agricultural colleges and to the post-graduate courses at Pusa are handicapped from the beginning by the fact that their basic training has not been up to the mark. I quite realise, however, that it is gradually being improved.

QUESTION 24.—ATTRACTING CAPITAL.—In the Punjab land has been given on easy terms to men who were willing to adopt scientific methods of cultivation. Scope for raising the standard of agricultural practice by this system is necessarily limited to Provinces in which there is land which Government can allot to selected men.

Within the last 30 or 40 years a large amount of capital has been applied to agriculture in India, for Government has spent crores of rupees in constructing tanks and canals for irrigation and roads and railways for the transport of agricultural produce. The rise in the value of land, the improvement of communications, the rise in prices, the opening of new markets, the security of the Pax Britannica has enriched the land-owning classes. They have got all they wanted without having had to exert themselves. Their tenants have been less fortunate.

There is ample capital in India among the larger landowners at least. It is enterprise, lack of interest in agriculture as a vocation and a sense of duty to the community which are lacking. They can be stimulated by demonstration and propaganda and by getting high officials interested in the work of the Department of Agriculture to use their moral influence in impressing on such men the fact that they should be India's leaders in agricultural development.

With a view to creating more interest in practical agriculture and to giving our landowners a wider outlook the Imperial and Provincial Departments of Agriculture should devote more time to giving informative lectures illustrated by cinema films and lantern slides on different aspects of improved husbandry.

Much of what I have said in my reply to the last part of question 15 is equally applicable to this question.

QUESTION 25.—WELFARE OF RURAL POPULATION.—Sanitary conditions in most villages in India are bad and the death rate is high as has been pointed out in the memoranda submitted by the different local Governments. The average villager is satisfied with a low standard of living and does not try to improve the conditions under which his forefathers were content to live. The Public Health Department in each Province is doing all it can to remedy matters: hygienic publicity and propaganda work is being carried out and the number of medical dispensaries is gradually being increased. In the way of propaganda Public Health Departments are giving lectures on general health subjects, illustrated in some cases by lantern slides and cinema films. In some Provinces leaflets and pamphlets are being distributed with the same end in view.

In most Provinces particular attention is being devoted in rural areas to the necessity of improving the supply of potable water and steps have been taken, too, to popularise the use of quinine in tracts subject to malaria. In such tracts the efficiency of rural labour is greatly reduced during the busy season, owing to the prevalence of malaria.

Speaking as a layman I am inclined to think that the measures being adopted for improving hygiene in rural areas are sound as far as they go, but rural hygiene is of such enormous importance that the amount being spent on it is inadequate. Till sanitary conditions in our villages are much improved, it will be difficult to get men of brains, enterprise and capital to settle therein. For the well-being and prosperity of our rural population the absentee landowners of this country are not doing enough; they live in the towns and take but little interest in the insanitary conditions prevalent in their villages.

Rural institutes for women have become very popular in England. As an experimental measure they might be tried in India as a means of awakening an interest in rural hygiene, in which women are perhaps more directly interested than men.

The Department of Public Health to the Government will be in a position to say whether sufficient provision has been made by the Imperial and Provincial Governments for investigation into the causes and incidence of malaria, cholera, hookworm, enteric, *kala-azar* and other diseases prevalent in rural areas.

QUESTION 26.—STATISTICS.—Little has been done in India in the application of the most scientific statistical methods to the elucidation of rural and agricultural problems. The statistical work is mainly confined at present to the drawing up of simple averages and percentages. A great deal more than this would be possible if scientifically trained statisticians were employed. Such statisticians could, for example, show the correlation between the rainfall and the outturns of *kharif* and *rabi* crops dependent thereon; between the rainfall and the incidence of malaria, etc.

Excepting in permanently-settled tracts the areas under cultivation and crops are already very accurately recorded.

The yield of agricultural produce should be based on the results of crop-cutting experiments sufficiently numerous to possess a definite statistical value. A statistical assistant should be appointed to work under the Director of Agriculture as recommended by the Board of Agriculture in 1924 and he should be given an adequate staff for carrying out crop-cutting experiments on a limited scale with the object of determining how such experiments can best be conducted.

The compilation of information regarding the rail-borne trade should be revived as recommended by the Board of Agriculture in 1924. As a result of the steps taken by the Indian Central Cotton Committee this has already been done in the case of **cotton**.

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APPENDIX 1.

Weak points in Education (from the "Statesman").**THE EXAMINATION.***Ill-equipped students at Dacca.*

In the annual report of the University of Dacca for 1925-26 reference is made "to the unsatisfactory preliminary education of many of the students whom it is necessary to admit to the University." The low percentages of students who passed the University examinations for the ordinary bachelors degree are, it is stated, due to this cause.

The report continues:—"It was stated in the last report that 'The work of the University is still handicapped by the backward condition of Secondary and Higher Secondary education in Bengal' and unfortunately this statement is still abundantly true. The majority of the students who pass the Intermediate Examinations of the Dacca Board and the Calcutta University are ill-equipped in the practical use of the English language and are not able to make adequate use of the instruction which they receive in the University during their first year, and in some cases, during a much longer period.

Further, it is often found that students who have passed the Intermediate Examination in such subjects as History, Logic, Politics, Economics and Mathematics, are not acquainted with the fundamental principles of these subjects. It is obvious that their study has been confined far too exclusively to the getting up of text books.

Science training.

The preliminary training of science students is still less satisfactory. The teaching of elementary science does not form a part of the curriculum of the High Schools of Bengal; the syllabuses in science subjects for the Intermediate Examinations of the Dacca Board and the Calcutta University are restricted in scope, and the science work in Intermediate Colleges is generally of a low standard. Practical work in the laboratory should form a very important feature of the training of intermediate science students, but in most of the Intermediate colleges of Bengal the laboratory accommodation is very inadequate and this side of the students' work is sadly neglected.

In the interest of students and of the public it is important that a high standard should be maintained in University examinations, and for this reason the percentages of passes in the University examinations of the session cannot be regarded as unsatisfactory. A general increase in these percentages cannot be expected until the standard of Intermediate Examinations in Bengal is decidedly improved."

APPENDIX 2.

Note on Agricultural Education in Vernacular Middle Schools written in 1919.

An earnest attempt is being made in the Central Provinces to improve rural education. The services of an officer of the Provincial Agricultural Service have been placed at the disposal of the Education Department with the view of organising Nature Study classes in rural schools and of making village school gardens a living and vital feature of primary education. Two agricultural middle schools are being opened shortly and four more will be constructed within the next 18 months. The aim of these farm schools will be to give a good general education combined with a training in the practice and principles of improved agriculture.

The aim of these measures is to adapt rural education to rural needs, but they do not go far enough. There is at present a hiatus between the primary school with its school garden and teaching of nature study and the agricultural middle schools being started on Government farms. Would it not be possible to formulate a scheme by which the teaching of Nature Study would pave the way for the teaching of the practice and principles of agriculture in middle schools. If such a scheme could be evolved, our agricultural middle schools on Government farms might then be converted into agricultural high schools. We would then have a graded system of rural education which would be carried on continuously from rural primary, to the rural agricultural high school, thus:—

- (1) Rural primary schools with nature study as an essential part of the teaching, in order to give the child an interest in nature, and a bent towards agriculture.
- (2) Rural middle schools with agriculture as one of the subjects of the curriculum, a definite attempt being made to teach the elementary principles and practice of agriculture.
- (3) Agricultural high schools where a general education would be combined with a more advanced course of agriculture.

In primary schools the education given is, I take it, already being organised on the lines referred to above. The agricultural schools to be opened on Government farms can each have a licentiate or graduate of agriculture on its staff and can, if necessary, be converted into agricultural high schools without difficulty. We have still to make provision for the teaching of agriculture in middle schools.

How to arrange for the teaching of agriculture in middle schools is a question which has not yet been seriously considered; but we have this year gained some experience in connection with the course of instruction given to boys of the Chaurai Middle School on the Chaurai Demonstration Farm. I have inspected this farm three or four times within the last year. The general impression which I have formed is that while the principle on which we are training the boys there is perfectly sound, the scheme as a whole is not applicable over a wide area. I will give my reasons for thinking so. In the first place, the Department of Agriculture, owing to the paucity of its staff, cannot arrange to open a similar demonstration farm for each rural middle school: the *kamdar* deputed to the Chaurai Farm is, as a matter of fact, the only *kamdar* in the department who has had experience in teaching as well as in practical agriculture. In the second place, I do not consider that the teaching of agriculture in middle schools should be considered one of the legitimate functions of the Department of Agriculture.

I take it for granted, therefore, that the Education Department will, in the case of my scheme being considered feasible, be prepared to find both the

land and the teachers qualified in agriculture. I do not think this will be difficult. The area of land required need not exceed four acres; an area of even three acres would do. The training of teachers for these schools could probably be taken in hand at the Agricultural College, Nagpur. A separate training school with hostel accommodation would in the long run have to be provided on the college farm, but in order to make a start at once, it might be possible to have the first batch sent to the Agricultural College for training in June this year. The Principal, Agricultural College, would have to be consulted as regards the course and the temporary arrangements to be made for staff.

The course should, I think, cover a period of one year. The teachers selected for this course should, as far as possible, be young men of the cultivating class who have been trained in pedagogy and who have already had some experience of teaching. On completing their training they could be appointed to middle schools, one to each, and their work should be inspected at regular intervals by Deputy Inspectors who have qualified in the theory and practice of agriculture.

I do not know exactly what subjects the curriculum for middle schools includes at present, and am not, therefore, in a position to say how many hours per week could be given for agriculture. I should like to point out, however, that in my opinion the number of hours given to practical agriculture could probably be added to existing school hours without causing any dissatisfaction. Nine hours for practical work and five for theory would probably suffice. All that they need be taught as theory is included in my book of Agricultural Lessons which is being published. They would get practical instruction in the cultivation of the staple crops of the locality and in that of new ones being introduced on improved lines.

It might be possible to make agriculture a compulsory subject in vernacular middle schools at least, and the existing curriculum would in that case have to be modified no doubt. The importance of the subject would, in my opinion, amply justify such action.

Great care would have to be taken in selecting the land and in equipping these school farms. A man of Mr. Nand Kishore's type would be required for this. The cost of starting such farms would vary from district to district. In Chhattisgarh, where land is cheap, the cost would be approximately as shown below:—

	Rs.
4 acres of land at Rs. 40 per acre	160
2 pairs of bullocks at Rs. 150 per pair	300
Buildings, including a cattle shed, a quarter for a <i>chaukidar</i> and a godown	1,800
One well	1,000
Implements—some sets in duplicate	800
Fencing	200
Miscellaneous	100
	<hr/>
TOTAL	3,860
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In Berar, the land would probably cost Rs. 800 and the bullocks Rs. 400, which would increase the estimate by Rs. 740. I consider a well absolutely essential to enable the cultivation of crops to be carried on throughout the dry weather. This building would include a shed for four bullocks, a very small implement shed, one godown and one quarter for a *chaukidar* who would look after the bullocks.

The farm should be within easy reach of the school. The soil of the site selected should be suitable for the cultivation of the staple crops of the tract.

It will be noted that the capital cost of a farm school of this type would be small. The recurring cost would be approximately Rs. 700 divided under the following heads :—

Rs. 96 for pay of *chaukidar*.

Rs. 300 for feed of bullocks.

Rs. 100 for manure and seed.

Rs. 200 average miscellaneous expenditure, including cost of renewing bullocks and implements.

If properly run, the farm receipts should cover at least half the expenditure.

APPENDIX 3.

Discussion on Agricultural Education held at Education Conference on the 3rd May 1919.

It was decided not to support the Director of Agriculture's recommendation for the grant of Rs. 10,000 for the free distribution of vernacular editions of the agriculture-readers now in the press.

Mr. Mayhew's letter, to which a general note by the Director of Agriculture is attached, urging the direct teaching of agriculture in vernacular middle schools, raises the whole question of the policy to be followed in agricultural education in village schools. It was agreed that while in primary schools the present policy should be adhered to, of attempting nothing more than is being done at present, namely, the improvement of nature study and of school gardens, the experiment now being carried out at the vernacular middle school at Chaurai in the Chhindwara district, though not conclusive, was promising enough to justify further experiment on the same lines. At the suggestion of the leading men of Chaurai, practical instruction on a small plot of about four acres near the school is being given to the school boys outside the regular curriculum and outside of the school hours. The land and cattle are provided free by the villagers and the owners of the land take the profit. A *kamdar*, who was already on duty on a demonstration plot in the village and who happens also to be a trained teacher, gives the practical instruction.

The success which has attended this venture so far can be attributed to the spontaneous co-operation of the leading local cultivators, and it was felt that it would be premature to accept the results as proving that similar plots for the direct teaching of agriculture in vernacular middle schools would be equally successful elsewhere. Moreover, no theoretical instruction in agriculture is attempted at Chaurai, and it is doubtful whether any addition can be effectively made to the present vernacular middle course as a part of the curriculum without detriment to general education. Dr. Clouston dissented from this opinion and was in favour of proceeding on the lines indicated in his note, which is attached to the letter from the Director of Public Instruction, but the other members of the committee thought that the general question was one which could only be decided by a specialist who has wide practical experience both of agriculture and of education. Besides, the present staff of the Agriculture and Education Departments has neither the time nor the specialised knowledge to undertake agricultural education in vernacular middle schools on a larger scale. It was, therefore, decided to recommend that an effort should be made to obtain such a specialist, who, in addition to deciding whether the Chaurai experiment was suitable for general application and whether indoor instruction should also be given, would be of great assistance as a general adviser to the Director of Public Instruction on matters of rural education. To obtain such a man it would probably be necessary to go to Canada or the United States of America, in which countries agricultural education has been carried much further than in any other. As experience of actual work is an essential, it would be necessary to select a man of between 35 and 40 years of age. It was suggested that Sir Frank Sly, from whom the idea of obtaining such an expert first originated, should be written to and asked to find out where such a type of man could be obtained and on what terms of salary he could be engaged.

If such an expert were engaged it would probably be two or three years before he knew enough of the country and the local conditions to advance with confidence; and it was felt that in the interval it would be useful to employ one or more local men on temporary terms, who are known to be enthusiastic in the cause of agricultural education. It should be the endeavour of such men to induce the people of the tracts in which they worked to imitate the people of Chaurai, and with the minimum help from Government to start

farm plots on that model. The establishment of more such plots would give further evidence from which to judge the experiment and the temporary men could be usefully employed in awakening parents, from whom the Education Department experiences a certain degree of opposition, to the fact that nature study and work in school gardens is for the benefit of the pupils.

It was, therefore, felt that it would be premature to ask for a share of the grant in the current year for establishing agricultural plots attached to middle schools, as proposed by the Director of Agriculture. Out of the grant of Rs. 1,50,000 given by the Government of India for the improvement of vernacular education a sum of Rs. 15,000 has been assigned for the pay of Mr. Nand Kishore, who is already doing useful work under the Director of Public Instruction in improving nature study work and school gardens, and for a reserve for the pay of a more highly qualified man obtained from outside India, should such a man be obtained. As the Director of Public Instruction stated that he could usefully employ the whole of the Rs. 1,50,000 on other objects, it was recommended that the Rs. 15,000 should be no longer earmarked for agricultural education, but should be at the disposal of the Director of Public Instruction for other purposes and that out of the special grant for the current year a recurring sum of Rs. 25,000 should be asked for, to provide the pay of Mr. Nand Kishore, and that of the local men proposed to be appointed and for any expenses which may arise in connection with the work which they will do.

APPENDIX 4.

BULLETIN No. 13 of 1921.

The Organisation of the Department of Agriculture.

1. For administrative purposes the Provinces have been divided up into Circles. At present there are three circles, namely, (1) the Southern Circle comprising the Chhattisgarh Division and all the Nagpur Division except Wardha district, Sausar tahsil of Chhindwara district, and Warora tahsil of Chanda district, (2) the Western Circle comprising all Berar Division, Wardha and Nimar districts and Warora tahsil of Chanda district, and (3) the Northern Circle comprising all the Nerbudda and Jubbulpore Divisions except Nimar district and Sausar tahsil of Chhindwara district.

2. The Director of Agriculture is responsible for the administration of the Department as a whole. In consultation with his experts he decides the lines of work to be taken up by each, the staff required to do that work and the extent to which different experts can co-operate in solving any special problem. He inspects at intervals the experimental and research work being done on the experimental farms and the extension work being carried out in the districts, points out any mistakes which have been made and suggests ways and means of overcoming difficulties.

3. In charge of each circle there is a Deputy Director of Agriculture assisted by a staff of Extra Assistant Directors, Agricultural Assistants and *kamdars*. The Deputy Director controls all the experimental work of his circle, and with the assistance of his Extra-Assistant Directors organises all the extension work including the supply of seeds and implements, field demonstrations, tahsil agricultural associations, etc. Agricultural Assistants are employed on Government farms and in supervising extension work in the districts. In immediate charge of demonstration work in the villages there are trained *kamdars*.

4. The existing circles are so very large and the activities of the department have increased so much within the last ten years that the three Deputy Directors now find it very difficult to exercise proper control over the unwieldy charges allotted to them. The three existing circles are therefore to be divided into seven circles as soon as sufficient staff to run them is available. The work of the department has increased enormously during the last ten years. Within that time the number of experimental farms has increased from 4 to 9, the number of seed and demonstration farms from 1 to 11, the number of cattle-breeding farms from 2 to 12, including two dairy farms, and the number of implements and parts of implements sold annually by the depôts of the Department from 280 to 1,832. The quantity of improved seed of the selected varieties supplied by Government farms annually has, within the same time, risen from 84,246 to 405,652 pounds and the quantity of sugar-cane seed from 24,370 to 420,534 whole canes. Nearly all the seed raised on Government farms is handed over to the owners of private seed farms who propagate it and sell the produce to their neighbours and others. In this connection expansion within the last ten years has been extraordinarily rapid, as may be gathered from the fact that the quantity of seed distributed annually through these private agencies has risen within that time from a few thousand to nearly 48 lakhs of pounds, and the number of canes from a few hundreds to over 342,000.

5. This is only a small part of what has been accomplished in the last ten years, for during that period a considerable number of small demonstration plots have been started, tahsil agricultural associations have been opened in about two-thirds of the tahsils of the Provinces, and the department has gradually got into touch with a large body of cultivators. The activities of the department have, in short, grown to such an extent within the last ten years that it is becoming increasingly difficult with our present staff to control

them properly. The office work of the Director and his Deputy Directors has also increased very much; for landholders are, year by year, taking a more intelligent interest in agricultural improvements, and now appeal more often for advice and assistance.

6. The research and experimental work of the department is conducted on its experimental farms and in its laboratories in Nagpur by highly trained scientists. The object kept in view has always been to discover new knowledge on which to base improved methods. Fruitful discoveries have been made after years of patient research. Improved varieties and strains of varieties of crops have been isolated and propagated for distribution on a large scale. Our *gurmattia*, *luchai*, *chinoor*, *bhondu* and other improved rices give much larger acreage outturns than the *deshi* varieties commonly grown. Sannabille, khari and Mauritius cane have, on their merits as *gur* producers replaced the *deshi* varieties almost entirely in hundreds of villages. Roseum cotton, isolated by the department fourteen years ago, is now being grown on an area of several lakhs of acres, and *buri*, a wilt-resistant cotton discovered fourteen years ago, is being grown on wilt-infected areas in parts of Berar. Improved varieties of wheat and *juar* have been given out in large quantities, and a method of preventing the latter crop from being damaged by smut introduced. Thousands of improved agricultural implements including ploughs, hoes, winnowers, fodder cutters and cane mills, which had not been heard of in the Provinces fifteen years ago, are now being used by landholders with advantage to themselves. Of iron ploughs alone the Department has sold 5,648 since 1907. Hundreds of thousands of cultivators now realise the merits of *Saoner*, *ramkel*, and *chapti juar*, and of A088, A013, A090, Pusa 12, Pusa 4 and other wheats given out by the Department. An improved type of *gur* furnace, known as the McGlashan furnace requiring no fuel but the trash and *megass* of the crushed cane, has been evolved; by using this improved furnace the cane-grower is saved the cost of from ten to twelve cartloads of wood for every acre of cane he crushes. Manures of different kinds tested and recommended by the department are also being used on a gradually increasing scale to supplement the very inadequate supply of cattle manure available.

7. The educational work of the department, too, has been of considerable value. Enterprising cultivators have learnt to appreciate the value of the improvements introduced and now talk with authority on the relative merits of selected varieties of seeds and of manures and implements, the names of which they had never even heard a few years ago. To stimulate this growing interest in agriculture a series of books, popular bulletins and leaflets have been published by the Department; for these there is a considerable demand. Of the small book entitled "The Story of Rai Sahib Kaluram Kurmi," the number of copies sold has already risen to about 15,000; and a large number of our popular bulletins have also been disposed of. It may be rightly claimed that all the extension work of the Department is of considerable educative value; the use of an improved implement or of an improved strain of seed teaches its own lesson in a most effective way. To meet the requirements of landowners desirous of giving their sons a training in the practice and principles of agriculture after they have passed the upper primary school two agricultural vernacular middle schools have been opened—one on the Chandkhuri experimental farm near Raipur and one on the Powarkhera experimental farm near Hoshangabad. Landholders desirous of giving their boys a more advanced training after they have passed the matriculation examination can send them to the Agricultural College, Nagpur, where a much more advanced training in the science and practice of agriculture is given.

8. Of the different kinds of farms run by the department experimental farms are the most important. They are designated experimental farms because our object on these farms is to discover new knowledge by experimenting. These farms are not supposed to pay; their function is to supply knowledge which when applied by the cultivator will enable him to make his farming pay. These experimental farms are in short the fountain head from which we gain most of our knowledge of new and improved methods of agri-

culture: the cost involved in running them is small as compared with the value of the results obtained.

9. Seed and demonstration farms are farms on which improved varieties of seed are propagated for distribution, and profitable methods of cultivation practised. The seed produced is supplied to the owners of private seed farms who in turn propagate it for sale to other cultivators. Some of the Government seed and demonstration farms in these Provinces are being run at a profit. They could all be run at a profit were it not for the fact that a staff of one superintendent and one clerk has to be maintained on each farm in order to guarantee its serving its purpose as a seed *dépôt* in the most effective way.

10. The department has opened a number of small demonstration farms or plots as they are commonly called. On these small demonstration plots the object in view generally is to demonstrate the advantage of growing a new crop such as cane, an improved variety or strain of an existing crop, or to demonstrate a new cultural method such as sowing in lines. The expenditure incurred in starting these demonstration plots is small. The land is taken on lease for five years, and only cheap *kutchā* buildings provided. The land is handed back to the owner when the lease expires. These demonstration plots are generally run at a small profit.

11. The department has eight cattle-breeding farms and has in addition two dairy farms on which milch breeds of cows and buffaloes are kept. On these breeding farms all the best breeds of cattle in the Provinces are represented. The cows and stud bulls on each farm are carefully selected and fed, and inferior animals rejected from time to time, the object being to improve the herd by better breeding and better feeding. That like begets like is a law of nature; given a good bull and a herd of good cows the offspring should also be good if properly fed and cared for. On these farms stud bulls are reared which are sold to cattle-owners for breeding purposes.

12. This brief outline of the work of the department deals mainly with the official side of its activities as carried out by a paid staff whose duty it is both to discover improved methods and to get the cultivator to apply them. The extent to which a new method is adopted by the cultivator depends very largely on the facilities provided for its introduction. One of the functions of the department is to provide these facilities. Cultivators are encouraged to form unions and to co-operate in growing the improved variety of seed recommended or to stock for sale the improved implements found suitable for the conditions which exist in their tahsil. All this so-called extension work requires a great deal of organisation and a great deal of tact, for the approval of the leading landowners has to be obtained and their assistance gained. Improvements are, in short, first introduced in the villages in consultation with and through the leading men. For this extension work a selected type of official is required who understands the principles underlying the improvement, who is thoroughly practical and who is tactful in his dealings with other men. They are recruited from the ranks of the subordinate agricultural service and are designated Extra-Assistant Directors.

13. The staff of the department thus consists of four classes of trained men, namely:—(1) Experts or Specialists, (2) Extra-Assistant Directors, (3) Agricultural Assistants, and (4) *Kamdars*. The expert staff includes Deputy Directors, the Principal of the Agricultural College, the Economic Botanist, the Agricultural Chemist, the Mycologist and the Agricultural Engineer. The Principal of the Agricultural College is responsible for the training of the students in the theory and practice of agriculture. The subjects taught include manures and manuring, crops, selection of seed, live stock, cattle foods and cattle feeding, dairying, veterinary science, horticulture, farm accountancy, the use of agricultural implements and tillage operations, etc. The students also get a thorough practical training on the College farm which is well-equipped with up-to-date appliances. On the research side the Principal is paying particular attention to the study of machinery as used on the farm, the principles of their actions, care of various parts, points to be attended to, so as to ensure economic running, etc. He is also making a

special study of dairying and of dairy breeds of cows and buffaloes. The Economic Botanist is responsible for the teaching of botany in the College, the Mycologist for mycology, and the Agricultural Chemist for chemistry, but these three experts also do a considerable amount of research work. The Botanist has taken up the improvement of the staple crops of the Provinces by selection and crossing, and has classified them into different varieties; he has under trial many exotic varieties likely to do well in this part of India, and is experimenting with different kinds of fruit trees. Chemical investigations involving the analysis of soils, manures, feeding stuffs, dairy produce, etc., to determine their composition and value are being carried out by the Agricultural Chemist. He is also studying in his laboratory problems such as the effect of fertilisers, green manures, bonemeal and cattle-dung on crops grown in different classes of soil; the effect of inoculating the poor lateritic soil known as *bhata*; the possibility of making artificial manure from grass and straw, etc. The Mycological Section of the departments is a comparatively new one, but the Mycologist has already started definite lines of research work on fungoid diseases of crops with a view to finding practical remedies. The Engineering Section of the department is also a new one. In these days of mechanical traction and operation this section will gain considerably in importance within the next year or two; for the tendency now is to utilise more machinery on the farm, and there is great need for expert advice and assistance in this connection. The Agricultural Engineer has already started a well-boring campaign with a view to assisting cultivators to obtain more water from their wells; he has carried out experiments with different types of motor tractors and tractor ploughs and is now training a class of young men to handle them. There is great need for new inventions and improvements in agricultural implements; one of his most important duties will be to effect improvements in existing types, and to invent new ones. Deputy Directors are experts in the science and practice of agriculture. Their duty is to carry out on the experimental farms under their charge experiments to test the relative varieties of improved strains of seed, of different manures and methods of cultivation, etc., to see that the results of these experiments are reliable and that correct conclusions are drawn from them. The problems investigated are complex and difficult, and to solve them requires the concentrated attention of a highly trained scientist. Unlike many forms of scientific work agricultural experiments only give results, as a rule, once a year. It is therefore all the more important to ensure that such results are worth having, and only reliable men, to whom accuracy is everything and who will place the trustworthiness of their experiments before the deductions it is hoped to make from them, should be in charge of experimental work. When a fruitful discovery is made at a station the Deputy Director in charge sees that it is handed on to the cultivators, for he is a practical scientific man who bridges the gulf between science and practice. All these different experts are always pleased to give the cultivator the benefit of their advice.

The progress that can be made in these different directions depends very largely on the qualifications of the experts employed. The type of man required is a well-trained scientist who has shown an aptitude for research.

14. The Extra-Assistant Directors of the department are doing district work, or they are employed as assistants to the experts and do research work or teaching. Those Extra-Assistant Directors who are doing district work are largely responsible for the organisation of the demonstration work in their circles. They are in charge of Government seed and demonstration farms, and co-operate with the district authorities in organising agricultural associations and in conducting the meetings thereof. They organise demonstrations to show the working of improved machinery and implements, and assisted by a staff of agricultural assistants and *kamdars* carry the teaching of our experimental stations and laboratories to the cultivator in his own village. With the assistance of officials and non-officials connected with the co-operative movement they have done much in the way of organising seed unions on a co-operative basis. Their advice is sound, practical and helpful; for they are selected men of much experience. They have done much, too, to assist managers of estates under Court of Wards to improve the cultivation

of the home-farms of these estates. They are the main connecting link between the expert staff of the department and the patient plodding tiller of the soil, for they take the results from the researches in science and reclothe them for his benefit in more simple and familiar language than that form, of necessity, used by the scientist. To make these results still more intelligible the Extra-Assistant Directors give popular lectures illustrated by magic lantern slides in which the results are explained in a graphic manner.

15. Agricultural Assistants are employed as superintendents or overseers of Government farms, as demonstrators in the districts, and as teachers and researchers. Many of them are young and inexperienced men who, if left to themselves, would be quite incapable of organising district work properly, as they lack experience and do not carry much weight with the landholders and others with whom they come in contact. The Extra-Assistant Director under whom they serve does the needful, however, in drawing up definite lines of work for each assistant and in keeping them up to the mark. The number of assistants available for district work averages only about two per district, and each has, as a rule, from four to five hundred villages in his circle. It is impossible, needless to say, for one assistant to get round so many villages, and arrangements have therefore been made whereby they are assisted by *kamdars*. These *kamdars* are in charge of demonstration plots and seed farms, and when a practical demonstration is carried out to show the cultivators how to sow in lines or how to work an improved implement or machine, for instance, there is a *kamdar* present to instruct them in the process. The agricultural assistants employed in teaching and in doing research work under the supervision of the heads of the different sections are doing useful work in training other young Indians in agriculture and the sciences allied thereto, and in learning correct methods of experiment and research.

16. Each class of workers, whether they be highly trained scientists, or organisers, or demonstrators has their own special lines of work, but all have the same goal in view, namely, the economic betterment of the cultivators of this country. Fruitful discoveries in agriculture as in other industries come as a rule after many years of patient concentrated effort; in no other way can nature be induced to reveal her secrets. To ensure progress it is all-important that our research workers should be given opportunities of carrying out their work to the best advantage: to hurry them or to worry them by unfair criticism would be fatal to that concentration of mind which is so necessary in research.

APPENDIX 5.

A note on the proposal to restrict the export of oil-cakes, bones and fish manures.

Much has already been written on the proposal to restrict the export of oil-cakes, bones and fish manures. In the light of the findings of the Indian Fiscal Commission, the proposal to prohibit export entirely need not be seriously considered. Most of those who advocate the imposition of a small export cess do so because they believe that it is highly desirable that the manurial substances produced in this country should be used for the improvement of the soils thereof. They believe, moreover, that the lack of demand for such manures is largely due to the ignorance, prejudice and poverty of the cultivators and that to remedy this state of affairs Agricultural Departments should have funds placed at their disposal to enable them to carry on propaganda work with a view to creating a demand for such manures.

2. The work of our Agricultural Departments is at present handicapped for want of funds. They do not have enough money to enable them to demonstrate on a large scale the value of these manures. Non-credit agricultural co-operation is in its infancy and little has yet been done to provide the cultivator with money with which to purchase manures on a co-operative basis. Faced by these difficulties many of our agricultural experts have advocated the levying of a small cess and the building up of a cess fund to be used for propaganda work with a view to popularising the use of manures. I do not think a small export cess of, say Re. 1 a ton on oil-cakes, bones, bone-meal and fish manure would appreciably affect the industries connected therewith in this country. But so much has already been written on this subject and so many unsound economic theories have already been advanced by amateur economists like myself, that I think, the time has come to refer the question to a higher authority, namely, the Tariff Board, the members of which are, presumably, in a position to study the question with reference to the effect which a cess of this kind will have on trade.

3. If the question is to be referred to the Tariff Board, I do not see the object of appointing a committee. The utilisation of supplies of nitrogenous and phosphatic manures might be brought up for discussion at the next meeting of the Board of Agriculture on the strict understanding that questions of tariff policy are to be left to the Tariff Board.

4. Most Indian soils must have reached their maximum state of impoverishment hundreds of years ago and will not get any poorer even if cropped without manures for hundreds of years more. An average crop uses up about 20 lbs. of nitrogen per acre but the loss is made up annually, for the soil gets nitrogen from the air and from the decay of root matter left in the soil after the crop is harvested, with the result that most soils are not getting any poorer in nitrogen. There are, on the other hand, certain classes of soil in India which are already deficient in available phosphate and which will tend to get more so if the supply is not replenished. The area affected is, however, small as compared with the total area under cultivation. It was definitely proved at Rothamsted, the premier agricultural research station in the world, that the unmanured soil there did not reach its maximum state of impoverishment till after being cropped continuously with wheat for a period of 40 years, since when the yield from year to year has remained almost stationary, despite the fact that no manure has ever been applied to the field. We may take it, therefore, that, with the exception of the limited area in this country the soils of which are deficient in phosphates, our old cultivated land has long since reached its maximum state of impoverishment; that increased yields now depend on the rainfall, standard of tillage and manure applied; and that only new lands or lands deficient in phosphates are being impoverished by cultivation. I raise this point because

Mr. M. K. Reddy Garu, M.L.A., and some of the members of the Madras Department of Agriculture have referred to it. They refer to the impoverishment of the soils in phosphates in certain limited areas.

5. Most Indian soils respond readily when manured with nitrogenous manures such as fish and oil-cake. That the demand for these in India has risen considerably within the last eight years is a healthy sign, proving as it does that the propaganda work already carried out by Departments of Agriculture is bearing fruit. The price of these manures has risen but, even at present prices, it pays very handsomely to use them for cane and certain garden crops. The cakes exported are mostly edible kinds such as linseed, ground-nut and cotton cake, the nutritive value of which is so high that it does not ordinarily pay to use them as manures. For these cakes, too, the demand in India is steadily growing and will continue to grow, for they are now being fed extensively on Government cattle-breeding and dairy farms, and many cattle-owners also are now beginning to use them.

6. What is wanted is propaganda to break down the prejudice and ignorance of the cultivator of this country. For propaganda and the organisation of the co-operative movement money is needed. If that money can be provided in no other way, I would be in favour of placing a small cess on the export of manures on condition that this cess should not go into general revenues but should be devoted to the encouragement of the use of manures as recommended by the Indian Fiscal Commission.

Margin of profit obtainable from the use of fish manure, oil-cakes and bone-meal.

Directors of Agriculture were asked to supply information as to whether there is or is not a margin of profit obtainable from the use of oil-cakes, bone-meal and fish manure in their Provinces. The figures they have given are mainly for last year, since when the price of food grains has fallen considerably. But as the price of these manures has also dropped, we may take it that the figures given in the last column of the statement attached, convey a fairly accurate idea as to what margin of profit is obtainable at the present time by using the manures named in column one for the crops named in column 3.

In the case of the more profitable crops such as sugarcane, chillies, onions and potatoes the profit from the use of these manures at present prices is very large as a perusal of the statement attached will show. When applied to less profitable crops such as paddy, wheat, cotton and ground-nut the margin of profit obtained is much smaller on the whole. In Bombay, the application of castor cake has increased the net acreage profit on cotton cultivation by Rs. 27 in one case and Rs. 42 in the other. In the United Provinces, the same manure has increased the net profit on wheat cultivation by Rs. 24 in one case and Rs. 25 in the other; while *neem* cake has in the same Province accounted for a profit of Rs. 16 when applied to paddy land. Bonemeal has given a net profit of from Rs. 10 to Rs. 14 when applied to paddy in Assam; and when applied along with a green manure, *viz.*, *dhaincha*, it has given a profit of Rs. 16. In Burma bonemeal applied to paddy has given a profit of Rs. 7 an acre.

The quantity of these manures produced in India though considerable would be far short of requirements if a real demand for them were to spring up in the tracts in which the more profitable crops are being grown. If such a demand were to arise there would be no manure to spare for less profitable crops such as cotton, wheat and rice. These manures are, in short, being exported at present, because the cultivator is not yet prepared to pay a fair price for them. Manure is so plentiful and cheap over the greater part of India in fact that cowdung, the value of which no one knows better than the

cultivator, is commonly burnt instead of being applied to the land. The reason for this is that he has not enough capital to grow on anything but a very small scale the more profitable crops which require manuring, irrigation and intensive cultivation generally.

These manures are, on the other hand, already being used on a fairly large scale for cane and garden crops by the more substantial landholders in the Provinces. The rise in their price of late years is largely due to the growing demand for them; the most that Government can do at present is to stimulate that demand still further by demonstrating their value through the Agriculture Department.

I have not been able to get any figures from the Director of Agriculture, Madras; but I gathered from him when I met him some months ago that these manures had dropped in price of late, and that they now gave a fair margin of profit when applied to cane and other garden crops grown in the Presidency.

Manure.	Province.	Crop.	Net profit per acre due to manure.
Fish	Bombay . . .	Sugarcane .	Rs. 154.
Safflower cake . . .	Do. . . .	Do. . . .	„ 176.
Safflower cake <i>plus</i> sulphate of ammonia..	Do. . . .	Do. . . .	„ 223.
Ground-nut cake . . .	Do. . . .	Do. . . .	„ 176.
Ground-nut cake <i>plus</i> sulphate of ammonia.	Do. . . .	Do. . . .	„ 199.
Safflower cake . . .	Do. . . .	Paddy . . .	„ 16 at present price.
Castor cake	Khandesh-Bombay	Cotton . . .	Rs. 27.
Castor cake	Jalgaon-Bombay .	Do. . . .	„ 42.
Castor cake	Nasik-Bombay .	Chillies . . .	„ 40.
Castor cake <i>plus</i> sodium nitrate.	Khandesh-Bombay	Do. . . .	„ 14.
Castor cake <i>plus</i> sulphate of ammonia.	Nasik-Bombay .	Red onions .	„ 63.
Do. . . .	Do. . . .	Onions . . .	„ 55.
Til cake	Central Provinces .	Cane	Ranging from Rs. 244 to Rs. 381.
Bonemeal	Do. . . .	Ground-nut	Rs. 8.
Til cake	Do. . . .	Wheat . . .	Nil at present prices.
Castor cake	United Provinces .	Potatoes . .	Rs. 32.

Manure.	Province.	Crop.	Net profit per acre due to manure.
Poppy cake . . .	United Provinces .	Potatoes .	Rs. 55.
Mahua cake . . .	Do. .	Do. .	„ 13.
Mustard cake . . .	Do. .	Wheat .	„ 24.
Castor cake . . .	Do. .	Do. .	„ 25.
Castor cake . . .	Do. .	Cane .	„ 80.
Bonemeal . . .	Do. .	Paddy .	„ 16.
Neem cake . . .	Do. .	Do. .	„ 45.
Castor cake <i>plus</i> sulphate of ammonia.	Bihar and Orissa .	Potatoes .	„ 106 to Rs. 130.
Castor cake <i>plus</i> nitrate of soda.	Do. .	Do. .	„ 93 to Rs. 107.
Bonemeal . . .	Surma Valley, Assam.	Paddy .	„ 10 to Rs. 14.
Bonemeal and dhaincha .	Do. .	Do. .	„ 16.
Fish . . .	Do. .	Do. .	„ 2.
Bonemeal and oil-cake .	Do. .	Do. .	„ 7.
Oil-cake and cowdung .	Do. .	Potatoes .	„ 44 to 64.
Bonemeal and cowdung .	Do. .	Do. .	„ 7.
Castor cake . . .	N. W. F. P. .	Cane .	„ 70.
Bonemeal . . .	Burma .	Paddy .	„ 7.
Cotton seed cake . . .	Do. .	Do. .	„ 21 loss.

APPENDIX 6.

BULLETIN NO. XX.

Some foes of the farmer in the Central Provinces and how to deal with them.

Owing to the very large area which still remains under jungle in the Central Provinces there is probably more damage done to crops by wild animals in these Provinces than in any other part of India. Wild pigs abound everywhere and make nightly raids on cane, *juar*, rice and other crops on which they feed all night returning to their haunts in the jungle in the early morning. One cane-grower lately informed me that his field of thick canes of which he had obtained the seed from the Department of Agriculture was damaged to the extent of Rs. 300 by pig in one night.

2. The counter measures that one naturally suggests in this case are (i) to destroy as many pigs as possible, and (ii) to protect the fields by fences. But as the pig is a nocturnal feeder and lies hidden during the day in the jungle or grass-covered wastes which are often many miles distant from the crops on which it feeds, to reduce their number to any appreciable extent will, I believe, take many years. In some districts of the Central Provinces cultivators are granted gun licenses on condition that they shoot a certain number each year. In the north of the Provinces a system of pig hunting with dogs has been organised and some thousands have been killed this season in that way. In villages, in jungly tracts pigs are often caught and killed in pits. Otter traps have been tried by the Department of Agriculture and by means of these a few pigs have been caught: but while the number destroyed by these different methods may total to some thousands every year, the number of young produced probably amounts to many hundreds of thousands. To obtain immediate and effective results in crop protection, therefore, the use of fencing is necessary, by means of which valuable crops in pig-infested areas can be saved from their ravages. To attempt to grow the thick juicy high quality canes which are so toothsome to pig from a porcine point of view would, in districts where pigs abound, appear to be a hopeless task without some such precautions.

3. The types of fencing used locally for cane fields are all more or less inefficient and it is customary therefore to keep also a watcher at night in the fenced field. His wild yells in the silent watches of the night on the approach of "grunters" are generally sufficient to scare them away; but at times, Homer-like, he often nods, and on such occasions the owner finds next morning that thousands of his canes have been destroyed and that his farming profits have been very materially affected thereby.

Where wood is plentiful, it is usual to construct a fence of thorns or bamboos, but on the efficacy of such a fence one never can entirely rely, as both pig and jackal bore their way through it.

Where jungle is distant a mud wall about 3' in height is constructed all round the field; this is generally effective in keeping out pigs if kept in a good state of repair; but jackals do not hesitate to jump over a wall of this height. Not only are the fences in common use at present inefficient but in the long run they are more costly than a *pucca* and permanent fence would be. To fence an acre with the branches of thorns or *garari* (*Cleistanthus collinus*) costs about Rs. 12 and lasts for one year only. In addition to this the owner has to meet the cost of retaining one watcher for 8 months and the practical certainty of a certain amount of loss. The cost per acre of the patent woven wire fencing now under trial is about Rs. 200 and it should last for at least 20 years. Barbed wire fences are quite useless.

4. As the problem of protecting cane had become a serious one, I had occasion two and a half years ago to suggest to the firm of Messrs. Burn and Company that they might design a strong woven fencing of the type of wire netting. The firm in reply sent a roll of patent wire fencing known as the Ideal woven fence which had been sent to them on trial from home. Page's fence supplied by Balmer, Lawrie and Co., is similar in construction to Ideal fencing, but the wire is of a lighter kind. Of both these patent fences there are several types varying in height and in the size of the mesh. We have tried several of these in the Central Provinces and have found that a fence about four feet high with a mesh 3 inches in depth at the foot, increasing to six inches at a height of 2 feet is, if properly fixed, quite effective in keeping out pig. For general purposes type No. 1150 of Ideal woven fencing is, as far as I have seen, the most suitable. It is supplied in rolls of 220 yards and costs 8d. per yard run. The fence is 50 inches high, and has eleven strands with uprights 13 inches apart. It is sufficiently strong to keep out cattle, sufficiently high to prevent *nilgai* from jumping it and the mesh is sufficiently small to debar pig. If properly stretched, jackals cannot get through it without considerable difficulty.

Patent woven fencing is being successfully used as a deer fence for a park in the Maharajbag gardens in Nagpur in which *nilgai*, *sambar*, antelope and *cheetal* are kept.

The chief points to be attended to in constructing a fence of this kind are (i) to see that the lower edge is two or three inches below the surface of the ground, (ii) that there is no space left between the lower edge of the fence and the ground, *e.g.*, at *nala* crossings, and (iii) that the wire is properly stretched. Nos. (ii) and (iii) are obvious points, but in the case of fences erected on our experimental farms I have noticed that the staff seem at first incapable of grasping their importance, and almost invariably leave an entrance somewhere. They only learn by sad experience that the habit of the pig on approaching a fenced field is to run along the wire in search of an opening. On several occasions pigs have got into our fenced areas by such openings, and their destruction when inside has given a considerable amount of sport. A large boar, which recently entered, by a *nala*, the cane area fenced with Ideal woven fencing on the Raipur Farm, after having made many attempts to find an exit, charged and knocked down several coolies and one of the farm staff, and died inside the fence fighting to the last.

No. 1150 Patent woven fencing described above costs 8 annas per yard exclusive of posts. In jungly districts where it is most required wood can be obtained at low rates and the cost of this patent fencing with wooden posts is approximately the same as that of an ordinary wire fence with iron standards. So as to obviate the necessity of having to renew these wooden posts after a period of years it will be found advisable to plant, between each pair, a cutting of *salai* (*Boswellia serrata*) or some other species which can be reproduced from cuttings. In two or three years these *salai* trees will serve the purpose of permanent posts. This method of fixing the wire is now being tried by the Department and will, I believe, prove satisfactory.

Semi-wild cattle, though of limited numbers and local occurrence, do an enormous amount of damage to crops in the vicinity of the jungles in which they live. The cattle live in herds of from 30 to 70 and there are few districts in the Central Provinces without one or two such herds. By day they are to be found resting in the jungle from which they pay nightly visits to the nearest cropped fields. These herds are no doubt the descendants of "strays" or of animals set loose as an act of religious merit by Hindus. They are generally in prime condition; are much more alert than domesticated cattle, and are often very furious when irritated.

To destroy those animals would offend the religious prejudices of the Hindus; to construct a fencing that will keep them out of a field is too expensive to be a practical proposition. The only feasible remedy left, therefore, is to capture them. Three methods of accomplishing this have been tried in these Provinces. The first was to entice these animals into a large *kheddah* strongly fenced with fencing of 8 barbed wires on posts 4 feet apart, each

supported by a stay to give it strength. The fence was interlaced, moreover, with thorny *babul* branches, and a trench 3 feet wide and 3 feet deep was dug to prevent the cattle when inside from rushing it. The cattle were enticed inside by *juar* stalks placed within. Trails of *juar*, salt and cotton seed leading up to the entrance were also put down. The area of 3 acres inside the *kheddah* proved much too large and great difficulty was experienced in approaching sufficiently near the enclosed cattle to lasso them. To throw the lasso for any considerable distance with effect was impossible owing to the number of obstructions in the form of trees. Moreover, when once enclosed, these cattle become dangerous and a man can only approach them in safety by taking shelter in a heavy cart with a hood. This was done and the lasso was thrown from the end of a long bamboo. Even after taking these precautions this method involves much danger for the lasso-thrower who is not constantly on his guard. To manipulate the bamboo properly, he has to come out of the cart and is liable to be charged at any time. While carrying out this operation for the first time two men were injured by an infuriated bull which charged and gored them. Over 30 animals were captured last hot weather in a *kheddah* of this kind, but we do not recommend it as the most suitable.

The second method that has been tried was to drive the cattle into nets placed in the more open part of the jungle. But this, too, was unsuccessful. The struggling of the animals in their efforts to escape resulted in the death of some of them from abortion in the case of cows in calf, and from what appeared to be congestion of the lungs in the case of other animals.

The third and most successful of the methods tried was to construct a very small *kheddah* 40 feet square, of strong wooden posts 3 feet apart and 7 feet high, with cross pieces 1 foot apart. To give this fence additional strength a strong stay was put in behind each post. The cattle are allured inside as described in the case of the previous method and the gate is then quietly closed by the watchmen in charge. They are then lassoed one by one by men who have taken up their positions in trees overhead. Fifteen were captured in this way recently without much trouble. This method is easily the cheapest and most expeditious that has yet been tried, and will be adopted in capturing other herds that are still at large.

APPENDIX 7.

Leadership in Agricultural Development in India.

Writing about 300 years ago on the subject of the importance of agriculture to a country, Markham said:—"A husbandman is the master of the earth, turning barrenness into fruitfulness, whereby all common wealths are maintained and upheld. His labour giveth liberty to all vocations, arts and trades to follow their several functions with peace and industry. What can we say in this world is profitable where husbandry is wanting, it being the great nerve and sinew which holdeth together all the joints of a monarchy?"

The salient facts regarding the state of agriculture in India are, (1) that it is by far our most important industry, providing as it does 3 out of every 4 of the people with a means of livelihood; (2) that it is in a backward state and has not as a vocation attracted any considerable number of men of brains, enterprise and capital, and (3) that the amount spent in India up-to-date on research and experiment with a view to developing this industry is quite insignificant compared with the enormous value of the interests involved.

The land is largely in the hands of owners who are rent collectors rather than agriculturists. They lease their lands to semi-illiterate tenants who seldom show any initiative or enterprise: other important industries such as the textile industry, the coal industry and the tea industry would, if left to the tender mercy of a similar class, have been doomed to failure. The idea seems to prevail that the agriculturist requires but a modicum of brains, capital and enterprise and that he can be relied on to work out his own salvation on empirical lines. Empirical knowledge alone is not sufficient, especially in this country where illiteracy is prevalent and where so few agriculturists are capable of understanding the correct relationship between cause and effect. Agriculture presents a large number of highly specialised problems which can be solved only by highly trained specialists; for research is the foundation of all progress in this as in other industries.

Improvements in agricultural practices must needs be based on accurate knowledge regarding our soils and their constitution, crops, breeds of cattle, plant and animal diseases, insect pests, etc., but such knowledge can be acquired only by research and experiment. The field of investigation is so wide and varied, moreover, that many highly qualified specialists each devoting his whole time to his own particular subject are required, if we are to wrest from Nature the secrets which would make for further progress. For the last 20 years or so such specialists have been working on these problems in India and great progress has been made in different branches of agricultural science. Thousands of varieties of crops have been sorted out, classified and tested, and new varieties have been brought into being by cross breeding. Improved breeds of cattle have been evolved by selection and crossing. New and more profitable methods of cultivation have been introduced on Government farms, and thousands of improved agricultural implements and labour-saving machines supplied to landholders. Diseases of crops and animals have been investigated and remedial and preventive measures devised.

Much has already been accomplished by the small staff of research workers employed by the Imperial and Provincial Departments of Agriculture, and the results of their beneficent work are now being applied in many villages. Progress in this direction would be much more rapid if the larger landowners of this country could be stimulated into taking a personal interest in the development of their own estates. Their apathy in this respect has been, and still is one of the main factors clogging the wheels of progress. How to break down this apathy is a difficult problem which has, from the very beginning, confronted the Department of Agriculture in India. If a solu-

tion could be found, the tree of scientific agriculture already planted in rural India would, in a decade or two, throw out its roots far and wide and produce in season fruits in plenty.

That agriculture is an honourable vocation, 'worthy of the attention of the best brains in India, our landed autocracy do not realise. It is so worthy a vocation that the King of England himself worships at its shrine. The King is proud to be a farmer and takes a personal interest in the management of his own estates. He is a Patron of the Royal Agricultural Society of England, too, and one of the most successful stock-breeders in the world. His sons are following his fine example as gentlemen farmers: His Royal Highness the Prince of Wales has extended his activities in this direction to Canada, too. If it were possible for the Viceroy of India to play the same part in this country as Royalty does in England the effect would be magical: for what our landowners stand in need of is leadership in the domain of scientific farming. No country in the world stands more in need of the driving and organising power of the State in the development of its agriculture than India; no country in the world stands more in need of leadership calculated to dispel apathy and to breathe life and imagination into the dry bones of our landed aristocracy.

If it were possible for His Excellency the Viceroy to associate himself in a practical way with the development of this great industry, the effect of his influence would be felt in every corner of rural India. If he were to establish a model farm, hundreds of our zamindars would follow his example, and that example would be handed on to thousands of smaller men, for agricultural improvements tend to filter down from the big estates to the smaller holdings.

Lord Willingdon, when Governor of the Bombay Presidency, was so convinced of the need of such leadership in the field of scientific husbandry that he opened his own model cattle-breeding farm at Ganeshkhind, and was the means of getting several Rajas in the Presidency to follow his example. In an article which he contributed to the *Agricultural Journal of India* on his herd of dairy cattle he wrote as follows:—"It is, I am convinced, largely the fact that the landowner has in England been a keen breeder of stock himself, which has produced the fine herds of cattle in that country, and which has encouraged the numerous agricultural shows, where we often find our King-Emperor, great landowners and tenant farmers all competing in friendly rivalry, and the tenant farmer not uncommonly proving successful over his Sovereign and his other august rivals. Is it too much to hope that a similar development in cattle-breeding may take place in this country?"

A concrete example of this kind repeated by His Excellency the Viceroy would strike the imagination of the landowners in a way in which nothing else could. It would stimulate their interest in farming and rural life generally, and give them a truer conception of the importance of agriculture and of the possibilities of promoting it.

APPENDIX 8.

Rural Education in its relation to Agricultural Development.

In the West the science and art of education have been much developed of late years: the science has been greatly enriched by the writings of such psychologists as Spencer, Bain, James, Adams, and others. Chairs of education have been established in some of our Universities. The great reforms in the methods of education, as now practised, owe much to the teachings of the educationists of the sixteenth, seventeenth and eighteenth centuries. In the latter half of the sixteenth century Montaigne condemned the pedantries of the schools which, he said, exaggerated memory while they depreciated the value of useful knowledge. Ratke and Comenius of the early seventeenth century also denounced the purism of the schools, in which so-called culture and scholarship were synonymous with ability to deliver elegant speeches in the dead languages. The latter was one of the first to lay it down as a principle that the teaching of words and things must go hand-in-hand. He was, moreover, one of the first advocates of the teaching of science in schools and his method of teaching a language was to teach it as the mother tongue, *viz.*, by conversation on the topics of every day life. Teaching, he said, should be made interesting by bringing the child into contact with actual things and the pupils should always be kept interested, cheerful, and happy. Locke in the end of the seventeenth century developed Montaigne's theories still further: he laid great stress on the training of the mind in order to fit a man for the duties of the world. The aim of education was, he said, to produce a sound mind in a sound body. Rousseau in the eighteenth century wrote his *Emile*: the influence of its revolutionary philosophy was enormous. The child, he said, must be a pupil of Nature. His *Emile* was taught by the real things of life, by observation and experience: he was to learn nothing from books, much by experience having read deeply in the book of Nature. Like Locke he laid great stress on the physical development of the child and on training his hand and eye. The strength and body of his *Emile* was to be fully developed: and he was to be athletic and good at handicrafts. Pestalozzi in the latter half of the eighteenth century still further developed and practised the science of education on more or less the same lines. Like Comenius, Locke, and Rousseau he followed Nature: the child's powers of observation had to be developed by training and his whole mind was to be gradually moulded by sympathetic contact with that of the teacher. Sympathy was all important in his method. Froebel, the mystic and disciple of Pestalozzi, like Comenius looked at the course of Nature for the principles of education. The duty of the pedagogue was, he said, to superintend the development of inborn faculties and to encourage self-activity of the child. Just as the farmer provides good cultivation and leaves the plant to grow naturally, so must the pedagogue give the mind of the child scope to develop. This consists in giving the child opportunities to live, act, and conceive, and at every stage of mental development the child must be cared for as the cultivator cares for his gradually developing plant. In his kindergarten (garden for children) he laid great stress on every child cultivating his own plot of ground: "to give them employment in agreement with their whole nature, to strengthen their bodies, to exercise their senses, to engage their awakening minds, and through their senses to make them acquainted with Nature and their fellow creatures," was to him the essence of true education. Of later day educationists it will suffice if I mention Spencer. To him science was the worthiest subject of study. The child should be trained in things in which it is interested, he said. The teacher's duty is largely to keep in sympathetic touch with the child and to foster its interest in natural things and to allow it to learn by the experiences of life—this being the way in which the young mind is developed.

Froebel has done perhaps more than any other for the progress of the science and of education. His kindergarten system for young children has on its own merits become almost universally popular as a method of teaching in the primary school. To the same system can be traced the origin of school gardens as a means to nature study.

At Home the study of education both as a science and an art has risen into great importance. Chairs of education have been founded in our Scotch Universities at least where the subject is included in the curriculum for the M. A. degree. Training centres, where the method of teaching is taught, have also been organised at several centres. As a result of all this, a great advance has been made of late years in raising the standard of teaching. The general trend of the new system has been to brighten school life. The system of rote-learning by which the child mastered pages of geographical names, historical dates, and rules of grammar has disappeared. New subjects have been added to the school curriculum with a view (i) "to train the young child to observe carefully and to reason correctly from the observations which he makes, (ii) to train the hand and eye to thoroughness by using them in doing things, and (iii) to foster such wholesale outdoor interest in the things of Nature which lie around him as will get him into the habit of approaching the unknown in a spirit of intelligent curiosity".

These new principles of education aim at the development of the child's intelligence by training him to observe and reason accurately. To give him manual skill and quickness of eye he is trained to do things for "the child must be induced to take as keen an interest as possible in his work and this is usually most easily achieved by means of exercises that lead to tangible results". The child gets his ideas from concrete objects which are familiar to him and which he can handle. In his nature knowledge lesson he no longer relies on books and pictures but on real objects. Each school has its little museum in which these are kept. He is trained to appreciate varying shades of form and colour by drawing and colouring figures with the originals in front of him. He draws from a real leaf, not from a line drawing of one. He mixes his own colours to get the shades required, and greets with unfeigned pleasure the discovery that yellow and blue when mixed give a green. The success obtained is very largely dependent on the fact that ample measures have been taken to train the teacher. At the university he studies the science and history of education; at training centres he is taught the art of teaching; and at other centres he learns his kindergarten, his nature knowledge, and art subjects for schools. A perfect system of classes for teachers has been organised, and elementary teaching has become a highly specialised profession. In towns these meet after school hours or on Saturdays. Rural teachers, on the other hand, attend central classes during their holidays.

I have briefly outlined the method of teaching which has been evolved in the West with the view of showing the enormous difficulties which have to be overcome before similar methods can be carried out here with any degree of success. I have discussed this subject with some Inspectors of Schools, more especially that part of it which refers to school gardens. Their views are pessimistic on the whole. They have not had the opportunity of specialising in teaching on the lines which I have described: their work is almost entirely administrative, and there are so few of them that they are not in a position to give any new system of education that amount of supervision which would be absolutely necessary in its initial stages. The general opinion seems to be that in the ordinary primary school the difficulty of teaching the child a little of the three R's, in the three or four years during which he attends school irregularly, is in itself a heavy task. They have not yet got qualified teachers nor the required appliances for teaching nature knowledge properly. School gardens have been established in most of the schools in the Central Provinces and in nearly half those of Berar: but they are not of much educative value: they are maintained almost entirely for ornamental purposes. The method of teaching in school which is practised is akin to that which has been con-

demned by educationists from the sixteenth century downwards. The child is taught mere words, not things: his memory is exercised, while his intelligence is left undeveloped.

I have inspected a good many of these gardens. They are on the whole fairly well kept and do undoubtedly serve a distinct purpose in so far as they help to brighten school surroundings and to give the child and his parents some idea of neatness, order, and beauty; but apart from that they are, under present management, of very little practical value as a means of education. The hardier annuals are grown with a few country and English vegetables; there is very little variety. In one school garden which I visited lately, I found English cabbages and bananas growing, the seedlings of which had been obtained from our Agricultural Assistant; but they were suffering for want of water as the boys were reported not to be willing to draw water from the village well; and the *chaukidar* who ought to have done this work had also refused to do so. In other schools, too, I have found that the question of water-supply is one that gives much difficulty in the management of school gardens. The parents are said to object to their children becoming "hewers of wood and drawers of water". The teachers are mostly of non-cultivating castes who have a natural prejudice against doing gardening or any other form of manual work, and are not therefore of the stamp likely to inculcate into the mind of the child a sense of the dignity of labour.

The equipment required for utilising the educative advantages which school gardening is supposed to supply is still very inadequate in these Provinces. This is not surprising when the facts already stated are taken into consideration; moreover, this branch of education is a comparatively new one even in the West. The subject of garden teaching in the curriculum of rural schools at Home only received official recognition within the last twenty years, and not before there was a trained staff of specialists qualified to teach this and other branches of hand-and-eye training. The value of school gardens when properly conducted can be considered under two heads: (i) educative, and (ii) utilitarian.

Under proper management their educative value is very great. Such teaching makes the school work more concrete. The child can be taught to make a line drawing showing the division of the garden and its different plots. He can be taught the elements of calculation in measuring the size and outturn of a plot, and in reckoning the outturn and profit per *bigha* or acre therefrom. Gardening can thus be correlated with other branches of school work. The child is trained in the observation of living and therefore interesting things which are changing from day to day. He makes his own observations and is trained to reason correctly from them. The responsibility of having to do things with his own hands makes him practical and resourceful. In carrying out the practical operations in the presence of the teacher and other class-fellows he is taught the dignity of labour and he gets a hand-and-eye training in the use of tools; he learns by doing things. If properly directed, an intelligent curiosity in his attitude towards Nature is created within him, and he becomes more and more anxious and able to find things out for himself. The attainment of this intelligent and sympathetic attitude towards his natural surroundings and this desire to solve their mysteries should be the main object in view in gardening as in other branches of nature study. This ideal is a high one, but I feel sure that if we are to rely on our present untrained Indian teachers to carry it out, failure is certain. Such aimless work as is being done at present, discredits the whole movement towards practical education. It is a premature attempt to graft a new and advanced system of education on to a primitive one by the help of teachers who have not yet been trained in the new system and who are therefore quite unqualified.

School gardens could not under present conditions be made of much practical value. But the great desideratum at present is to get teachers trained in the method of teaching nature study for which the school garden is only a means to an end and I am of opinion that to do this

successfully it would be necessary to employ a specialist who has fully qualified himself in the science and art of teaching at Home and could be relied upon to turn out teachers qualified in the method of teaching, for nature study is *largely a method of teaching*. It is for the Education Department to decide whether it would be better to do this or to train one of their own men. A two years' training at Home would probably suffice. He would be entirely responsible for the teaching of nature study, drawing and kindergarten in the Training Colleges. Acting teachers would come there for holiday courses. The specialist would have a model school garden and a museum at each training centre and would frequently take his students out into the fields to study the geology, the *flora* and *fauna* of the country. Manual training including kindergarten and art subjects suited to local conditions, would be taught at the same time. One of his first duties would be to prepare a set of lesson sheets suitable for the Provinces: another important task would be the preparation of a Science Reader for the use of middle schools in co-operation with members of the Scientific Departments of the Administration.

The student would learn how to manage a model school garden and how to utilise it as an object-lesson. Each student would have a separate plot of at least one-twentieth of an acre which he should cultivate with his own hands. In addition to this there would be a communal garden area used more especially for common teaching purposes. Given teachers trained in this way it would then be possible to make existing school gardens of considerable educational value. But the teacher would not depend entirely on the school garden: he would also take out his boys into the fields to study Nature on a larger and more varied scale there.

If taught in this way nature study would necessarily give the child an interest in agricultural subjects as the teaching would be in the concrete and the object-lessons would nearly all be connected with agriculture. On these lines the perceptive, reflective and reasoning faculties of the child's mind would be developed, and it would not be too much to expect that the training, acquired in this way while at school, might be of the greatest practical value in after-life.

I am well aware of the fact that any great improvement in the quantity or quality of rural education in India must be of slow growth as was the case in England, where we first developed our industries and thereby enriched the country before evolving that high standard of rural education which we enjoy to-day. Our Government first raised the economic condition of the people and then taxed them heavily for the support of education. In India there is a crying need for more and better rural education among the educated classes at least; but these same classes attach as yet but little importance to the training of the ryot in improved agricultural methods which would enable him to rise in the economic scale. They do not yet fully realise the fact that to create in him that spirit of enterprise, self-reliance, and resourcefulness which are so essential to success in agriculture, his education even in the rural school must be made more practical than it is at present.

It is a well-known fact that much of the education given in rural schools at present is compulsory in nature though not in name. But for the pressure exercised by Government officials in securing attendance, many of our village schools would stand empty. For the average ryot education has no charms because he does not see its advantages. For those of the clerical class the case is of course quite different. For this class education is absolutely essential to fit them for their life's work. The ryot does not see that agricultural prosperity is in any way dependent on education. This is, I consider, a very strong argument in favour of the steps now being taken by Government to develop Indian Agriculture. The development of this, our greatest industry, should precede the development of rural education. If we first demonstrate to the ryot that improved methods bring him prosperity, it will then be an easy matter to prove to him that to enable his boys to benefit to the full from these improvements, education is indispensable.

Oral Evidence.

1. *The Chairman:* Dr. Clouston, you are Agricultural Adviser to the Government of India?—Yes.

2. It is a post you have held for?—For about three years.

3. Before I proceed to ask you one or two questions on the proof which you have been good enough to prepare and which has been in the hands of the Commission some days, I should like to ask you whether you would care to make any statement supplementing the written matter which you have put before the Commission?—I do not think it is necessary.

4. I imagine that after the Commission has completed its tour round the Provinces most of us, and certainly I, will have a good deal more to ask you than we have to-day; but there are some questions mostly of a general nature which I should like to put to you this afternoon. I should like to know whether you would care at this stage to tell the Commission on what, in your view, the need for a Central Government Department of Agriculture is founded, having regard of course to the fact that agriculture is now a provincialised subject. Would you care to make any general statement of that sort to-day?—I have already given my reasons for thinking that we require a strong central department in my replies to question 1 and question 4. I think there is great need for co-ordination and that the tendency is for each Province to work by itself; there is no opportunity of co-ordinating the work either between the Government of India and the Provincial Governments or between the different Provincial Governments themselves.

5. Are you prepared to tell the Commission that in your view there is less co-ordination to-day than there was in the past between Province and Province?—I think there is certainly less co-ordination than there was, say, before 1920.

6. And is that to the prejudice of agricultural progress as a whole?—I certainly think so.

7. You have no doubt studied the practice in other parts of the world and particularly in States with a federal constitution; have you observed that in the United States of America, for instance, a strong central Agricultural Department is maintained?—Yes, I know that, that is the case in Australia and to some extent in Canada too.

8. In fact, it is almost universal in progressive federal organisations, is it not?—It is to a greater or less extent.

9. I will not go point by point through the reasons which you have given in support of your view that a central organisation is necessary; but I want to direct your attention to one point in particular. It is your view, I understand, that one good reason for research by a central organisation, that is to say, an Imperial Department in the case of India is that there are not enough research workers of the highest calibre to staff separate research stations in every province?—That is so.

10. Are you satisfied with the calibre of the Heads of departments at Pusa at the present time?—We used to get very good men for Pusa but within the last 5 years we have had very great difficulty in getting men to come from the Provinces when we require them because they think that their prospects in the Provinces are better than their prospects in the Imperial Department. I think we have got very good men for Pusa in the past; but I believe we shall have very great difficulty in getting equally good men in future. We have asked for the services of certain men working in the Provinces and these men have told us that they were not prepared to come to Pusa.

11. You think the conditions of service, prospects and salaries at Pusa are not to-day such as to attract the best research workers; is that the position?—Yes, that is the position.

12. Do you agree with me that the usefulness of Pusa as a central research station rests in a great measure on the prestige which the research workers in Pusa enjoy throughout India?—I quite agree.

13. Mediocrity is not wanted?—I believe that a research worker is of little or no value if he is a mediocrity. He must be a really good man, otherwise he is useless.

14. Now how about the direction and co-ordination of research at Pusa? Is that in your own hands in particular?—Yes, as Director I am responsible.

15. And you are advised, are you not, by something in the nature of a council composed of your colleagues?—Yes, we have a council.

16. Do you think that that council, in its capacity as an advisory body, is proving sufficient, with your own responsibility super-imposed, for the carrying out and co-ordination of research at Pusa?—I think it probably is, but I should be very glad to get assistance from research workers in the Provinces if we could possibly arrange it.

17. I do not quite understand?—I mean that if we had a central organisation on the lines that I have suggested we should be very pleased to get advice from the members thereof as to what lines of research we should carry on at Pusa, but at present we are not sufficiently in touch with the work being done in the Provinces. We are more or less isolated at Pusa.

18. You have not indicated the nature of the powers of central body the creation of which you advocate. Am I right in thinking that your intention is to give this body executive powers?—My proposal was to have an advisory council; it would not have executive powers but working with it I would have an executive council which would have executive powers.

19. And the funds at the disposal of that executive body would be the funds at the disposal of the Department of Agriculture supplemented, if necessary, from general revenues?—Yes.

20. Is continuity in matters of research of paramount importance?—Of the very greatest importance I should say.

21. Do you think that the method that you suggest would provide an assured future for research?—I think it would if the Provinces would agree to accept my scheme; I have discussed it with a number of Directors of Agriculture who seemed to fall in with the idea of having some such organisation.

22. So that going about India from Province to Province you have formed the view that some scheme of that sort would appeal to the Provinces?—Yes, that is my opinion. We were to have discussed the scheme and to have worked out the details at the last meeting of the Board of Agriculture, but when Government decided to appoint this Commission they gave orders to the effect that my scheme should not be discussed by the Board, as it did not go far enough.

23. It would strengthen your remarks about the lack of co-ordination between Province and Province if you could give the Commission any instances of such lack of co-operation and co-ordination?—There is I consider no co-ordination at all between the Provinces at the present time. Our heads of sections, who tour in the Provinces find that they are welcomed in some Provinces while in others they are not. Some Provinces at least do not want them to inspect work being done by their research workers.

24. With regard to the field of research, is it your experience that the research workers in one Province do not make themselves aware of the lines of research being carried on in other Provinces?—Well, only in so far as they can get such information from the reports published in other Provinces.

25. And are you satisfied that by the means they adopt to make themselves informed of the research carried on elsewhere, they do not in fact obtain all they require in the way of information?—Yes, I am quite sure that they do not. In the case of research work being done on cotton, the Central Cotton Committee is now co-ordinating the activities of different departments.

26. Now before I pass on to another question, another branch of our enquiry, do you wish to say anything about the efficiency of the officers of

the Imperial Department other than the research workers? Do you think that in their case the pay and prospects are sufficient to attract the right men?—I think it is; the pay is reasonably good. It has been increased within the last few years.

27. Are you satisfied with the service given by the staff as a whole?—As I have already pointed out in my replies to your questionnaire we lost some of our best men, and the department is not so strong as it was five years ago.

28. Now, pursuing the arrangement adopted in your memorandum, I should like to ask one or two questions about agricultural education, first about agricultural colleges. There is a great deal in your memoranda of the utmost interest, and the whole of the Commission have read with the utmost attention the very interesting series of notes attached to the provincial memoranda and the memoranda of the Central Government which were written by yourself, and we are immensely grateful to you for the trouble which you have taken in preparing those notes. I say that because I do not wish it to be thought that the points that I am bringing out are the only ones of interest. I am only concerned at this moment to ask you one or two general questions, and in this matter of agricultural colleges I should like to ask you whether you think that in principle it is sound to attempt to train officers who are to take their place in the agricultural service of the country and those who are to return to their paternal acres as practical farmers at one and the same time. Do you think that the attempt to train the official and the farmer side by side is a sound one?—I think it is, if you provide at the college a separate two years' course (for practical trainers and a four years' course for men who are being trained for the department). I think that a Province cannot afford to have several different institutions for training men in agriculture. I consider that the two years' course ordinarily given in agricultural colleges is quite suitable for prospective farmers: it is largely practical. Our colleges are well equipped, they have got their farms, they have got their herds of cattle and they have got their up-to-date implements, so that additional students can now be trained at a very small cost.

29. I should like to ask you whether working day by day with school-mates who are to go into the official service does not tend to turn the minds of those who enter the college with a view to return to their farms, to the possibility of obtaining an official status?—Well, it might have that effect; but I think the men who make up their minds to get into Government service, or to farm their own lands as the case may be, do so from the very beginning. The men who before entering an agricultural college make up their minds to return to their own lands stick to that decision I think.

30. Reading through the series of memoranda that have been provided for the Commission I have noticed that no statistics as to after-careers have been presented. Do you follow what I mean?—Yes; in the Central Provinces I know what happened to the men. We took about ninety per cent of them into our department as assistants; the remaining ten per cent got employment with landowners or went back to their land; but the number that returned to the land was small. In the Bombay Presidency a higher percentage of the students become practical farmers we are told; the people are, however, more advanced in that Presidency.

31. *Sir Henry Lawrence*: What is the reason?—I think, agriculture is more advanced in the Bombay Presidency.

32. *The Chairman*: Do you know whether agricultural colleges in general make a practice of following the careers of their students and thereby discovering what in fact their after-careers are?—I think they know their careers fairly well for the reason that the Department of Agriculture has its assistants in every district and these assistants are in touch with the men who after having taken a college course have settled on the land or have taken up posts as managers of private estates.

33. Do you think that the principle of linking the agricultural colleges with the Universities for the purposes of degrees has proved a success?—I think it has. The Poona Agricultural College, for instance, is one of the

best in India; it was affiliated with the University a good many years ago. I think that is one reason why it has attracted so many students. The Nagpur College which was affiliated last year has in consequence attracted a larger number of students this year, I am told; moreover, students of a better class have applied for admission.

34. And that is because of the prospect of getting a degree?—Yes; a degree gives a man a better social status.

35. To what posts in the public service does an agricultural degree help a candidate's chances?—A few of the men who took the diploma of the Agricultural College in Nagpur used to get into the Revenue Department as Naib Tahsildars or Revenue Inspectors. A few were given posts as Assistant Managers of estates under Court of Wards after they had had a few years' experience in the department.

36. Do you think that the possession of an agricultural degree may well count for rather more than it does at present in a man's candidature for posts other than those in the agricultural departments?—I think it should; I think that a degree in agriculture should count as being equal to a B.A.; but I am not sure that local Governments would agree, as a matter of fact I think they are inclined not to.

37. That is a very important consideration, is it not?—The men who have taken a degree at an agricultural college have had a scientific education. From the literary point of view they are not as good as a B.A. and for that reason perhaps they are not so well fitted for certain Government services.

38. Now, I want to turn for a moment to those students of agricultural colleges who mean to return to the business of farming. It is a very important and difficult step for a young man to pass out direct from an agricultural college to his own farm, is it not?—Yes; it is always better if it can be arranged to give them practical training in the Department of Agriculture with a view to enabling them to gain some experience before they take over the sole management of their own lands.

39. Would that provide them with commercial knowledge and experience?—A good deal, for the reason that we keep records and accounts of different kinds on every farm.

40. I want to get down to the roots of this question, and I may put my point in this way. It is bad enough to lose 20 or 30 marks in an examination paper; it is a good deal worse to go to your own farm and drop half your capital; and I want to know from you whether you think that all that might be done is being done to bridge over this difficulty for these young men who go to the agricultural colleges with a view to take up farming?—As far as the Central Provinces is concerned I think we did all that we could possibly do. The trouble was that a very large number of students were men who did not belong to any agricultural class; they did not really want to go back to the land.

41. In one of the provincial memoranda before the Commission, I read of a suggestion (which was rather more in the nature of an experiment), that successful and promising students would be given an opportunity of cultivating land on very favourable terms for five years or so after they leave the college. Do you know about it?—Yes; I know the scheme; it is being considered in the Punjab; I believe it has not yet been sanctioned, but it is under consideration.

42. *Sir Ganga Ram*: It has been sanctioned; the period has been reduced from five to three years.

The witness: I think you want my opinion on it. I should say that a student after having taken a degree in agriculture is certainly not likely to be a successful farmer until he has had some years' experience. It takes years and years to make a successful farmer; and if land is given to inexperienced men the chances are that a good many of them will prove failures. If we had an experienced officer to keep an eye on them and advise them for some years, then a scheme of that kind might be quite successful.

43. *The Chairman:* In other words, a man may be a skilled technician but he might not be any good at farm management?—Students fresh from an agricultural college know very little about the practical side of agriculture for the reason that they do not find time to give much time to the practical side when they are at college, and, as you know, it takes many years' experience to make a successful farmer.

44. Now, I should like to ask you whether, in your view, teaching stimulates research? Or, in other words, whether the presence of a teaching school stimulates research when both are carried on side by side?—I have always been inclined to think that it does, but there are a great many research workers who disagree with me. They think that when they concentrate on any special piece of research work they have not enough time for teaching.

45. Is it possible to have any particular research worker left in peace; that is to say, is it possible to have an arrangement of work whereby a research worker does not do any teaching but nevertheless if such a research worker is in contact with those who are teaching from day to day, that is a valuable thing?—I think it should be.

46. Would you call Pusa a live teaching centre?—I should say it is. The men who go there for training take post-graduate courses. The Heads of sections guide them in their research work and also give lectures at times: they take a keen interest in the training of these post-graduate students in short and are always in touch with the work they are doing.

47. And you yourself would like to see the teaching side of the work in Pusa extended?—If we were to extend it, it would be necessary to increase the staff. Most of our sections contain only one Imperial Service Officer and if he were to devote all the time that is necessary to research, he would find very little time for teaching.

48. How many students are there at Pusa for the moment?—I am afraid I cannot tell you that off-hand. I think there is about a dozen at the present time.

49. Now, do you think that any of those students who are at present at Pusa are likely to develop into scientists capable of directing higher research?—I think so. Some of them are reported to be very promising.

50. Of course, the teaching at Pusa is entirely post-graduate, is it not?—Yes, we have lately given up what we called our short courses.

51. How about the scientific equipment of students, I mean of the degree-men who come up to Pusa for the courses?—This is our great difficulty. Most of them when they come to Pusa are not well equipped for taking a research course. This year, for instance, there were 16 men who applied to be admitted to the post-graduate course in chemistry, and not one of the 16 was considered qualified for that course.

52. It takes a long time to make a first class research worker, does it not?—We take them for two years only; I consider that that is too short a time really.

53. Do you think a man who, either through fault or because he has no opportunity, has not properly acquainted himself in essential sciences, can ever make up that difficulty in after-life, or do you think it is a lasting handicap to his career as a scientific worker?—I think that if a man has not got the basic education to start with, it is extraordinarily difficult to become a successful research worker; if he has not got a sound basic education in short, I do not think he is ever likely to develop into a very efficient research worker. I consider that, at the present time, the teaching of science in the Arts colleges in India is not good.

54. How do you account for that?—I think they have not been able to get first class teachers, nor have they been able to afford the cost of laboratory equipment, which is fairly high; still I quite realise that the standard of teaching is gradually being improved.

55. Do you think that it is very important for the future of agriculture in India that University teaching in pure science should reach the highest

standards?—I think so. I think that existing standards are an obstacle so far as the training of men for the highest posts in the service is concerned, graduates in science are given post-graduate courses at Pusa. It is reported that their knowledge of science is deficient and that they cannot be put on to research with advantage.

56. Then in your memorandum you turn to the question of elementary general education on page 3. You say that the village school is fundamental to any scheme of rural regeneration, and in this note you develop your ideas of the direction which elementary education ought to take in rural areas, and you are plainly of opinion that nature study should form one of the pillars of elementary education in rural areas?—In primary schools it should be. For vernacular middle schools the Punjab system of agricultural education is, I believe, suitable.

57. Do you think that, broadly speaking you are faced with this alternative, that either you will devote your resources in the main to achieving and sustaining literacy or you will make some sort of attempt to interest or even to educate a small child in agriculture? Do you think that is an alternative?—I am afraid I do not quite follow your point.

58. Let me put it in another way then. Do you yourself believe in trying to teach small children the practice of agriculture?—No, certainly not.

59. Do you believe that in the short period during which most children in India attend schools, there is time to teach them more than the essential elements of literacy? Do you believe that the time taken in attempting to educate small children in the principles of nature study is justified?—I think it is. As a matter of fact, the Education Department has, in some Provinces at least, already included nature study in the curriculum for primary schools. I know that in the Central Provinces nature study lessons were given in primary schools. What I mean by nature study lessons, are lessons on such subjects as the parts of a flower, and the uses of the different parts of a plant.

60. I used to be taught my arithmetic on such matters as wall papering, and the hands of a clock and so on; you would teach arithmetic of that sort, but in terms of agriculture. You would not attempt to teach anything in the nature of practical agriculture to small children?—Not at the primary school, but in the middle school one can teach them how to handle implements, how to sow seeds, how to use hand tools, how to irrigate crops and so on. That is already being done in the vernacular middle schools in the Punjab, in which they teach agriculture.

61. Of course, literacy in itself quite apart from any agricultural bias which may be imparted would be an immense advantage from an agricultural point of view, would it not?—Yes, I quite agree.

62. Have you any grounds for supposing that the attempt to teach nature study and to interest growing boys in natural history in the life of plants and so on has in fact tended to make those boys better cultivators?—I am afraid not, for the simple reason that the first attempt to teach agriculture in a school in the Punjab was not made till about 1920, and there has not been time to test the system. At Home there is a great deal more attention now being paid to the teaching of nature study in our schools, and the general opinion is that it has had an effect both in making the pupil more intelligent and in making him take more interest in agriculture.

63. You think that is the general opinion at Home?—I think so.

64. Of course this problem of keeping the rural population on the soil is not merely an Indian problem, is it?—I think the problem is world-wide.

65. Would you agree with me that the two main impediments to the movement of the rural population towards the towns are bad communications and lack of education?—Yes, I should think so.

66. So we are really faced with this difficulty, that, while both communications and education must be improved for the sake of agriculture, that very improvement is going to increase the tendency to leave the rural areas and

go towards the towns?—On the other hand, I think it is possible to raise at the same time both the standard of education and the standard of living in the villages; that would tend to prevent the villager from deserting his village.

67. So as to increase the attractions of a rural life?—Yes, by improving sanitation for example.

68. Would the bettering of the economic prospects of the cultivator not do more to stop the drift towards the towns than even an agricultural bias in elementary education? Is it not really a question of economic opportunity?—I think it is largely that, perhaps; but on the other hand, land-owners, who have land in the villages, prefer to live in idleness in the towns. They are not doing any work and are not earning any money there: they live in towns for the reason that they know they can enjoy there a higher standard of living.

69. It is not merely a question of rupees; it is a matter too of amenities, of amusements, is it not?—Yes, the amenities of life are very much better in the towns than in the villages.

70. There is one passage in the paper which you have provided for the Commission, in which you say on page 22 that there is at present a hiatus between the primary schools and the agricultural middle schools being started on Government farms. I do not quite understand those words?—What I meant was this; nature study is taught in primary schools to boys of from 6 to 10 years of age. These boys were not allowed to join our special vocational schools in the Central Provinces till they were 14 or 15 years of age. From the ages of 10 to 14 there was thus a break in our scheme of rural education.

71. I understand, thank you. Now as regards secondary education: And here again I shall have many questions to ask you when you come before us again, as I hope you may, after our provincial tours. I should like to know from you whether you think that the cultivator to-day is more inclined to encourage his son to undertake agricultural education than he was when you first knew him?—I think he is. When our agricultural colleges were opened, we had much more difficulty in getting suitable students than we have at the present time. I think that applies to most of the agricultural colleges in India. There are more applications for admission now-a-days than there used to be, which seems to indicate that the course of training given is becoming more popular.

72. And as another test of the movements of public opinion, do you think that landholders are more apt to appreciate the value of engaging a manager who has had sufficient agricultural training than they used to be?—Not to any great extent. I do not think the land-owners have as yet wakened up very much to the importance of having trained men as managers.

73. May not that be due to the fact that candidates for such employment lack experience in management?—Yes, it is partly that. A landowner sometimes employs a man fresh from the college who has had no practical experience; in many cases such men though they may have taken a degree or a diploma in agriculture have not, owing to lack of experience, proved satisfactory as farm or estate managers.

74. Are the after-careers of boys who have passed through the secondary schools charted? Are they recorded by way of discovering what proportion of those boys have turned to farming?—You mean by the Education Department?

75. Or by the institutions themselves? Are the figures available?—I notice that in the report on the working of the Bombay Department of Agriculture, the Director states how many of his students have returned to the land!

76. Well, that is as regards a particular institution. But I think you will agree that, an exact test, by means of after-careers is very important! An exact test of what the future of those boys who undertake agricultural edu-

cation proves to be is very important?—We know fairly well what has happened to all the men we have trained at Pusa: they have nearly all gone to the Provinces and hold appointments in the Agricultural Departments thereof.

77. That is a very different thing from knowing from what has happened to boys who have passed through the middle schools and so on?—In his annual report on the working of the Department of Agriculture, the Director of Agriculture in the Bombay Presidency states how many of the students trained at the Loni and other vocational agricultural schools have gone back to the land.

78. How about the proportion of the total funds available for education which is being expended on the attainment of literacy as compared with that which is being spent on secondary education and higher education? Do you follow my point?—Well, I am not sure whether you mean by secondary education, secondary education in agriculture or education of a purely literary type.

79. I should say general?—The amount spent on agricultural education is quite insignificant. There has been no attempt to teach agriculture in schools, except on a very very small scale. They have about 60 schools in the Punjab, over 40 in the Bombay Presidency, and a few in the United Provinces. They have 6 special vocational agricultural schools in the Bombay Presidency. The total cost of running these schools is very small. The percentage of the total expenditure on education spent on these different forms of agricultural education is probably a fraction of one per cent.

80. As regards the question of general education, the percentage of literates in the total population is very low, is it not?—The percentage of the population which is literate is very low. It varies from Province to Province. Over 90 per cent. are illiterate, I believe.

81. I will not take you further in that matter because it is of course the concern immediately of another department. But as you have touched on the question, I wanted to know whether in your view the best possible was being done to teach the three R's to school children in rural areas. Apparently your view is that the best is being done, considering the difficulties?—Yes, I think so. But I think we should provide more money for nature study in primary schools and for the teaching of agriculture in vernacular middle schools in rural areas.

82. Then you turn to demonstration and propaganda. Without demonstration and propaganda, the results achieved by research workers cannot be placed at the disposal of the cultivator?—That is so.

83. Do demonstrators, as such, suggest to research workers lines which might prove profitable for investigation?—Yes, they do so. The Deputy Director very often makes suggestions to the Chemist, to the Plant Breeder, to the Entomologist and other specialists.

84. Do you think full use is made by research workers of the opportunity of getting into touch with actual problems through demonstrators, getting into touch with problems that require attention?—I think so. Research workers visit Government experimental farms in their Province and come to know what agricultural problems there are in the different tracts. They sometimes tour in the districts too, when they find time.

85. So you think there is sufficient touch between workers who are concerned with research and those who are concerned with demonstration?—I think so. It is the duty of the Director to see that they work together.

86. You say that agricultural improvement should only be recommended after it has been thoroughly tested on the Government farm or farms. Is it your experience that the cultivator of India is a very cautious person? Do you think him over-conservative?—I do not think so. A good many land-owners are quite willing to try experiments. If you once mislead them they are disheartened. You have got to be very careful not to make the mistake of giving them wrong advice.

87. The man of very small resources is inevitably disinclined to make risky experiments?—As a rule we do not expect them to do so. We get the bigger men to try out the improved seed. Then the bigger man, having satisfied himself that it is superior to the local varieties, propagates it and hands it on to smaller men. In the early days of the Department officers who were anxious to produce rapid results, sometimes gave out seed of strains or varieties which had not been very thoroughly tested. In the year in which I came out to the Central Provinces a very large quantity of seed of a variety of cotton called *hani*, a fine stapled cotton, was given out by the department to cultivators. It gave a very much smaller yield than the varieties commonly grown and gave the cultivator a very much smaller profit, but these facts were not seriously considered before the seed was distributed.

88. To the cultivator deeply in debt, the possibility of a slight increase in returns is not, I suppose, a great attraction when you are endeavouring to persuade him to sow an improved seed?—That is so. If he does not get an increase of at least 10 per cent. he does not even notice it.

89. It really means nothing to him?—It does not mean anything, because he is probably paying 20 per cent. or even 30 per cent. interest on borrowed money. On the other hand, approved seed does not cost him anything more than ordinary seed, as a rule.

90. So that still less would he be inclined to make experiments when he has to pay rather extra for the material?—Yes, if he has to pay more, but I think the Departments of Agriculture charge as a rule only a very very small premium, if any, for improved seeds.

91. What form of demonstration do you think most effective in persuading the cultivators to adopt an improved seed?—The most effective form is that by which you get the cultivator to adopt the improvement in his own village and on his own land. In the case of an improved strain of seed, for example, he cultivates the land with his own implements, and grows the improved seed under ordinary village conditions. He sees that when it is grown under ordinary conditions even, it produces an increased yield.

92. On what terms is that class of demonstration carried out? On what arrangement between the department and the cultivator in question is demonstration on that plan carried out? Do I understand that there is something in the nature of a partnership between the department and the cultivator during the period of demonstration?—Only in so far as the seed is supplied by the Department. The Department gives out the quantity of improved seed required to sow a definite number of acres. The cultivator propagates the seed and distributes it among other cultivators in the village.

93. If it happens that he has suffered loss as a consequence of sowing the seed recommended by the department, the cultivator himself would have to bear the loss?—In the Central Provinces, we guaranteed our seed growers against loss when we first gave out improved cotton seed, but we never had to compensate them as they never suffered any loss.

94. You point out the importance of co-operation by the department with the District Officer, with the officials of the Irrigation, Co-operative and Veterinary Departments and no doubt you would also add the Forest Department? Would that arise in this context?—I think I would, but we do not find it quite so necessary to co-operate with the Forest Department. We do not seem to have so much in common with that department as with the other three mentioned.

95. I should like to pursue that matter at this stage a little further. Do you mean that the lack of touch with the Forest Department is general?—No, I think not. The Chief Conservator of Forests was a member of our Board of Agriculture in the Central Provinces. At our meetings forest management in its relation to agriculture was sometimes discussed, but the two departments have, as yet, relatively few interests which are common to both.

96. Do you ever make representations as a department to other departments on behalf of cultivators in any particular district?—Very often to the Irrigation Department with regard to irrigation questions.

97. No doubt that obtains between departments in the Provinces as well?—
I think so.

98. What is your opinion as an officer of the Agricultural Service on this point? Do you think that there is a sufficient knowledge amongst officers of the Forest Department of the opportunities which their Service has in assisting the agriculturist and cultivator?—I think the Forest Department is assisting the cultivator as far as it can. I have always found the officers of the Forest Department very reasonable in their attitude towards the cultivator.

99. You do not suggest that there is any aloofness or lack of, shall I say, combination or co-ordination between the departments?—I think that there may be in some Provinces, probably, but, where they have what they call a Provincial Board of Agriculture, there is a good deal of co-ordination.

100. Is it your experience that landlords generally in India play their part in advancing the cause of progressive agriculture?—I do not think they play their part well. In the Central Provinces, the smaller land-owners who are men owning anything from 40 to 200 acres co-operated with us a great deal in measures for helping the smaller cultivators. The bigger land-owners take very little interest in the practical side of agriculture.

101. Among European countries the landlords have done a great deal?—I have stated that in one of my replies, that the great development in farming in England in the 18th Century was largely due to men like Bates, Bakewell and Townshend, who were gentlemen farmers.

102. In ryotwari districts there are no landlords, strictly speaking? Who stands as landlord in the ryotwari districts?—The *patel* who is the headman of the village, corresponds to the landlord.

103. You do not think Government stands as the landowner?—The *patel* represents the Government, in a way. He collects the rents for Government and gets a certain rate of commission. He has, as a rule, a fairly big area of land in the village.

104. Do you think that in what Government has done for cultivators in ryotwari districts it has shown an example to landlords in other districts?—I have not had sufficient experience but I know that in Berar, where we have the ryotwari system, the standard of cultivation is very much higher than it is in the Central Provinces where we have the *malguzari* system.

105. I was interested in your statement that the publication of leaflets, bulletins and books, describing in simple non-technical language improvements advocated by the Department, have in some Provinces stimulated interest in agricultural improvements. Remembering the extraordinarily small percentage of literacy amongst the rural population, I was a little surprised that you put so much emphasis on the value of leaflets?—It is a fact that in a village sometimes you find the schoolmaster or other literate person reading these bulletins to quite a crowd of cultivators who are illiterate.

106. Under the heading Administration, you say that the recruitment of Europeans has been stopped and the tendency in some Provinces at least is to stop recruitment of Indians from Provinces other than their own and that the field of selection is thus being narrowed, and the standard of efficiency lowered. Is it possible to support that view by any facts?—I think so. Quite a number of posts which were held in the past by very able and experienced officers are now held by men who have been promoted from the Provincial Service. The latter have not had anything like the training that the men who previously held these posts had had. You will find that quite a number of posts in the Imperial Service are held by such men who have been promoted from the Provincial Service.

107. And you think that this tendency that the Provinces are showing to limit recruitment for their Services to the inhabitants of the Province is likely seriously to affect the efficiency of the services?—I certainly think it is likely to do so.

108. I suppose that the position is, for instance, as regards the higher research positions, that there are very few first-class men available, and you

have to pick them where you find them?—Yes. If we have a wide field to draw from, we are likely to get good men. If we have to recruit the men from the Province to which they belong we are restricted to a very narrow field of selection.

109. Then you make the proposal, in order to strengthen the Agricultural Department and in order to give the Hon'ble Member in charge of the portfolio of Education, Health and Lands more time for the administration of the Department of Agriculture, that it is desirable to relieve him of some of the subjects for which he is held responsible at present. You do not say how you propose that the subjects which will be discarded if your suggestion is accepted should be administered. What do you think should be done with them?—They might be attached to the portfolios of existing Members.

110. You do not think your proposal necessarily involves the creation of a new portfolio?—I did not have that in my mind. I wanted to relieve the present Member of some of the subjects for which he is at present responsible. I know he is a very hard-worked man; and if we are going to advance agriculture and give more attention to its development from the top, that is from the Government of India point of view, the Hon'ble Member and Secretary concerned should have more time to devote to agriculture.

111. Then you turn to the Meteorological Department and you point out the possibilities of development for that department. I should like to know whether it is your view, remembering the stringency of the times, that that is a direction in which further expenditure would be immediately justifiable?—I think, it would. If money can be found, I think we should make a start. The Head of Meteorological Department has suggested that one Imperial Service Officer and a certain number of assistants should be appointed for agrometeorological work; the cost would be very small.

112. Do you think anything more could be done than is being done at present to place the material provided by the department at present before cultivators?—I think something could be done, but at the present he has got no staff for looking at problems relating to agriculture.

113. Then you turn to finance, and you say that some of the best authorities hold that banking in rural areas should be expanded by the development of co-operative credit and by the recognition of the indigenous banking system in India, and its adaptation so far as possible to modern banking conditions, rather than by its supersession by joint-stock banks managed on Western lines. I am not sure exactly what you mean by the words "the recognition of the indigenous banking system in India and its adaptation so far as possible."?—I mean that instead of introducing joint-stock banks as we understand them, we should base the system on the existing Indian system of banking.

114. I thought that was what you meant. Have you tried to work out a scheme?—No, I have not given it sufficient consideration.

115. I was interested to see that you attach importance to the cinema (page 10 under the heading of Fragmentation of Holdings) for purpose of persuading cultivators of the disabilities from which they suffer as a result of excessive fragmentation. Have you had a good deal of experience of propaganda by means of films?—I have had a little. We have got a cinema camera at Pusa and we have been preparing films for some time.

116. It is not an easy matter to prepare films, is it?—It is very difficult. We have not got trained people to do the acting. The G. I. P. Railway Company have prepared some very good films, and they are getting a special man out from Home for cinematograph work.

117. Have you ever yourself been present when the films were being shown to a purely rural audience?—Yes.

118. Did they appear to follow the points?—I think so, or at least they seemed to laugh heartily at certain pictures.

119. At the right places?—Yes, and I believe the G. I. P. Railway Company have had audiences of 30,000.

120. Such a thing had never entered my mind before, but it was suggested to me by someone who ought to know that some of the backward peoples found great difficulty in appreciating cinema films because of their inability to understand an illustration presented in two dimensions, that is to say that they are so unaccustomed to seeing photographs or pictures that a good many of them did not grasp what was being put on to the screen. Do you think that is likely?—Not likely in the case of a moving picture. When they see the movements, then they cannot help understanding.

121. The suggestion was made to me by someone who knew India so well that I paid attention to it. Do you not think that the cinema offers a wonderful opportunity of bringing home certain facts to a population largely illiterate?—I think it does. For that reason I am very keen on making full use of it.

122. I am sure the present staff at Pusa does its best to fill the bill, but may it not be that the moment has come when you might consider the desirability of initiating a small branch concerned with the preparation of cinema films for demonstration and propaganda purposes?—We have been considering that, but I think that the Railway Company I have mentioned is prepared to do the work. As we experience great difficulty in getting money out of Government for such purposes, I think we had better leave our film work to this Railway Company. They propose getting a special man out from Home for this class of work.

123. If the cinema is going to prove one of the most important engines of education in agricultural matters, do you really suggest that you should leave a job like that to the railways?—I am very much against it, but it is very very difficult at present to get money for such objects.

The Commission then adjourned till 10-30 a.m. on Wednesday, the 13th October, 1926.

Wednesday, October 13th, 1926.

SIMLA.

PRESENT :

The MARQUESS OF LINLITHGOW, D.L. (*Chairman*).

Sir HENRY STAVELEY LAWRENCE,
K.C.S.I., I.C.S.
Sir THOMAS MIDDLETON, K.B.E.,
C.B.
Rai Bahadur Sir GANGA RAM, Kt.,
C.I.E., M.V.O.
Sir JAMES MACKENNA, Kt., C.I.E.,
I.C.S.

Mr. H. CALVERT, C.I.E., I.C.S.
Raja Sri KRISHNA CHANDRA GAJAPATI
NARAYANA DEO of Patlakimedi.
Professor N. GANGULLEE.
Dr. L. K. HYDER.
Mr. B. S. KAMAT.

Mr. J. A. MADAN, I.C.S. }
Mr. F. W. H. SMITH. } (*Joint Secretaries.*)

**Dr. D. CLOUSTON, M.A., D.Sc., C.I.E., Agricultural Adviser to
the Government of India.**

Further Oral Evidence.

124. *The Chairman:* I will now turn to Question 9, under the heading Soils. Has there been a systematic soil survey of British India?—Soil surveys have been carried out in certain Provinces, but not in all.

125. Do you advocate a systematic soil survey of the whole of the area?—I think it would be useful. At present we have not got the men to carry it out.

126. Is it a very expensive operation?—It would probably mean that each Province would require a chemist for that special piece of work.

127. How long do you think it would take to carry out a soil survey of the whole of British India?—I am afraid I could not tell you. A chemist would be in a better position to do so. I think it would take some years to carry out such a survey in a single Province.

128. A word about your proof under the heading of fertilisers: Are the results of experiments carried out in Europe a reliable indication of what may be expected to be the results of the employment of manures under Indian conditions?—I think not, for the reason that soils in Europe are more deficient in phosphates than soils in India. A good deal of the manure applied in Europe is manure containing phosphate in some form or other. The manure we require for India is manure containing nitrogen principally.

129. And as regards nitrogen, is the sunlight factor in India very important as compared with the sunlight factor in Europe?—I think not.

130. You do not think the natural regeneration is more active in tropical countries than in Europe?—I think that in India the nitrates are washed out of the soil to a greater extent than in Europe. You have the optimum conditions for nitrification and there is a greater loss of nitrates.

131. So that, water apart, in your view, the absence of nitrogen is the principal limiting factor in India?—I think so. There are certain soils that are deficient in phosphates, but the area is comparatively small as compared with the area that is deficient in nitrates.

132. Has the short season available for ripening an important bearing on manurial questions in India?—It has a very important bearing; the

manure is wasted in the case of crops grown in the monsoon if they do not get the manure at the right time. It is washed down into the subsoil, beyond reach of the roots of the plant.

133. And how about the tendency of nitrogenous fertilisers to delay ripening? Has that been found by experience to be an important factor?—I do not think it is very important in India. It does delay ripening slightly, but not to any appreciable extent.

134. You have no hesitation on that account in recommending nitrogenous fertilisers to cultivators?—None.

135. Do you think sufficient basis of experiment exists for firm recommendations to cultivators in the matter of fertilisers?—I think so. In certain Provinces they have been carrying out experiments with fertilisers for several years and they have got results on which they can rely. In Bombay they have been using sulphate of ammonia for many years as a manure for cane. They are now using it on a fairly large scale there; I believe that over two thousand tons of sulphate of ammonia were sold to the cultivators last year in that Presidency. The planters in North Bihar have been experimenting with nitrate of soda and sulphate of ammonia for many years too, and are now using much more than formerly. In Madras also they are using fish manure, and oil-cakes, etc., on a much larger scale than formerly.

136. It is not your view that there is a large field of inquiry open to research institutions in the matter of fertilisers?—I think that more experiments should have been carried out in the Provinces; the excuse is that they have not had an adequate staff, nor the money required for experiment on a large scale.

137. Are you carrying out important experiments at Pusa in this matter at the present moment?—We are conducting series of manurial experiments both on wheat and sugarcane.

138. Are you satisfied with the scope of the experiments being carried on at Pusa on this question?—I think we might have done more; but we have started some new provincial experiments within the last year.

139. Is night-soil a very important potential source of fertilising material?—I do not think it is very important for the reason that the quantity available is very small and always will be small.

140. Prejudice apart, need it be small?—In the bigger towns, they are using incinerators and there is little or no poudrette made; but I think they could conserve a much larger quantity of it than they do in smaller towns.

141. Are you familiar with the work being carried on by Mr. Fowler at the present time?—No, I am afraid I have not seen the work he is doing.

142. Do you agree that this question might assume very important proportions if large quantities of treated night-soil were at the disposal of cultivators?—You mean in the villages?

143. Yes?—I do not really know that there is much scope for extending its use.

144. Is it not possible that export of prepared material from the large areas of population to rural areas might take place?—Yes, but the quantity would be very small.

145. The argument as to whether there is a progressive decline in the fertility of the soil in India is one which is perennial. You express the view that there is no progressive decline, speaking in general terms, taking place at this moment, except possibly in phosphates in certain areas?—Yes, and except in areas where the soil is of a virgin nature, the fertility is gradually decreasing. But most of the area under cultivation in India has been under cultivation for hundreds of years and had reached its maximum state of impoverishment many years ago.

146. I notice that in several of the papers placed before the Commission it is deplored that there are no body of persons trading in India in the position of seed merchants such as we have in Europe. Is that the case,

that there are no seed merchants?—I think that is the case. The owners of the seed farms which we have in the Provinces are seed merchants in a sense; for they propagate and sell seed. The difference between them and seedsmen at home is that they do nothing to improve the seed. They merely propagate on their farms improved seed supplied by Government.

147. Do you think it might be possible to encourage the starting in business of seedsmen in India?—I think it would certainly be advisable to encourage it and I think the time will come when some of our students who have been trained at our agricultural colleges will set up as seedsmen like Garton and Sutton at Home.

148. Now I will turn to your answer on the question of damage by wild animals. Has this question received a great deal of attention in your department?—No, I think it has not. It is very important. We discussed it last year at our meeting of the Board of Agriculture and made certain recommendations which are now before the Government of India.

149. Is a very important proportion of the total damage done by wild animals brought about by wild pigs?—I think the wild pig probably does more damage than any other animal.

150. Are domestic pigs kept in rural areas to any important extent?—They are kept in the villages where there is a fairly large population of low caste people; they do not do much damage, because they are under control.

151. That was not in my mind. What I was going to ask you was whether (I am fully aware of the dangerous nature of the suggestion) the possibility of introducing some disease specific to the pig had been considered?—That has been considered and at our meeting of the Board, one of the recommendations was to the effect that an officer should be put on special duty to study the habits of the pig and to find out, if possible, some disease which, if introduced, would kill them off.

152. Was that a recommendation or has an appointment actually been made?—A recommendation was made at the last meeting of the Board of Agriculture that a man should be put on special duty to study the habits of the pig with a view to finding out ways and means for reducing their number.

153. The pig is a hardy animal and is not likely to be killed by resolutions. Do you think that active steps are likely to be taken?—Certain diseases have killed off a great many of our wild animals. The wild buffalo, for instance, suffers from rinderpest.

154. Plainly, the practicability of such a suggestion rests upon the assumption that the domestic animals of the same kind and liable to the same disease are not present in important numbers?—Yes.

155. Now, on page 13 of your note you refer to cultivation. You say that scant attention is paid in many parts to rotation of crops. Is that through ignorance or improvidence, in the main?—You may call it improvidence, but it is due to the fact that the cultivator thinks that by growing the same crop year after year he can make more money than he can by rotating it with another crop that brings in less return.

156. You see the point of my question: Does he at the back of his mind know as well as you know the value of rotation?—I think he does.

157. So that it is due to improvidence?—He does not foresee the fact that by growing the same crop in a certain field year after year he may bring on disease. He learns that by experience.

158. Might not heavy indebtedness have an influence on his mind in this matter?—It may but I had in mind the cultivators in Berar where the well-to-do people grow cotton year after year without rotating it with another crop.

159. In many of the memoranda before the Commission the importance of an improved system of dry cultivation has been emphasised. Do you think that an ideal system of dry cultivation may solve the problem of the

seasonal unemployment in rural areas? In other words, do you think that the increased amount of work required to meet the needs of an ideal dry cultivation might afford a substantial increase in the amount of labour required in what is at present the slack season?—It would add considerably to the amount of labour required, but at the present time the difficulty is that there are no implements suitable for dry cultivation.

160. A great deal of material has been put before the Commission in the matter of tillage implements. I should like to ask you one question. Do you think that any important improvement is possible without improved bullock-power?—Yes, I think improvement is possible; a good many of our improved ploughs are really lighter in draught than the *deshi* ploughs. An efficient plough is light in draught. If we could introduce on a large scale an efficient plough like the *sabul*, it would be very advantageous because it goes to a greater depth than the heavier *deshi* ploughs used in the Deccan and it can be drawn by a pair of good bullocks as a rule, whereas the heavy *deshi* plough capable of doing the same class of work requires two pairs.

161. I suppose turning of the sod is not necessary in India to kill the weeds?—The great thing is to expose the roots of the weeds to the sun.

162. Is it, then, the price which in the main prevents the cultivator from purchasing and using a better implement?—I think it is partly the price and partly the fact that most of the improved implements recommended are not entirely suitable for Indian conditions.

163. How do you account for the fact that someone in India does not come forward and supply this demand? Does it not offer an immense opportunity commercially?—We have the firm of Kirloskar Brothers in Bombay, who have manufactured and sold about 150,000 agricultural implements including over 100,000 ploughs since they started their business.

164. How long ago was that?—They started, I believe, about 1890, so they have been working for a long time. Other firms say that there is no big demand at present for agricultural implements and it does not pay them to manufacture them on a large scale, as they cannot rely on finding a market for them. In other words, there is no proper organisation for the sale of agricultural implements in India at present.

165. Do you think that improved communications will expedite the change to better implements?—I think so, and we might get Railways to reduce the freight on implements too.

166. You agree, I see, that the improvement of cattle in India is one of the most important questions on the agricultural horizon?—I think it is.

167. I now turn to page 15 of your memorandum, Animal Husbandry. Do you believe in the soundness of the present arrangement according to which cattle improvement and dairying come under the Department of Agriculture while veterinary matters alone come under the Veterinary Service?—Yes, I do believe in it; you cannot with advantage divorce cattle breeding from arable cultivation and the production of fodder crops. The raising of food-stuffs is very much more important than the disease side in cattle breeding in India.

168. Having regard to the generally accepted importance of an improvement in the breeds of cattle in India, is it your view that sufficient stimulus is likely to be imparted to the attempt to improve cattle in India under the present arrangement? Do you think that the matter is to-day receiving the attention it deserves?—I think it is not. We have, as a Board of Agriculture, put up recommendations time after time with respect to cattle improvement, but some of these recommendations have not yet been given effect to. For instance, some of the Provinces have not as yet got cattle experts, and until a Province employs an expert, I do not think that it can do justice to this big question.

169. Would you have this expert under the Department of Agriculture?—
Yes.

170. Would you not have the Veterinary Service under that officer?—I do not think it really matters much. I think the present arrangement by which the Veterinary Adviser deals direct with his Government in the Province is probably all right.

171. Do you think that the lessening of the incidence of disease is likely to prove one of the most important factors in the improvement of the breeds of cattle in India because of its effect upon the minds of those who may be considering expenditure in an attempt to improve breeds?—I do not think it is so very important.

172. Do you think a man is prepared to invest his money to improve the breeds of cattle in India as readily when he knows that the whole of his cattle may be swept away by disease as he would if reasonable immunity and security were provided?—I think reasonable immunity is already provided. The disease which carries away most of the cattle in India is rinderpest, and by the simultaneous method of inoculation we can give permanent immunity. On Government farms where cattle are immunised against rinderpest we lose very few cattle from disease.

173. No doubt this simultaneous method of inoculation is proving extraordinarily satisfactory, but is its administration satisfactory?—It has proved satisfactory, as far as I know, in the Provinces in which it has been tried. They tried it in Madras and Mysore State.

174. It is a question of degree?—But you have not got the staff in the Provinces to carry it out on a large scale. That is the obstacle to progress.

175. At the moment, the breeding problem is in the hands of the Agricultural Department?—Not in all Provinces. In the Punjab it is in the hands of the Veterinary Department.

176. I mean as regards Imperial centres?—We get our cattle on Imperial cattle-breeding farms inoculated by our Muktesar staff.

177. What I am going to ask you is this. Do you agree that heredity is one of the most important factors in resistance to disease?—Yes, I believe it has a good deal to do with it.

178. I see that you are of opinion that further attention might well be given to fruit growing and horticultural matters generally?—Yes.

179. Do you think that is likely to grow into something important in India?—I think there is great scope for developing the fruit industry, but very, very little has been done up to date in that direction.

180. And yet expenditure in this direction would appear from the material placed before the Commission to be a good investment?—I think so. After seeing the Tarnab farm in the North-West Frontier Province, I think you will agree that under expert supervision a great deal could be done to promote fruit-growing in this country.

181. Now I come to a very different subject. You have referred the Commission to another note in which you have given your views as to forestry and agriculture in India. I want to ask you this question. Do you recommend the uniform enforcement of the higher scale of grazing rate as a means of eliminating from the grazing in the forests the poorer beasts who are not in a position physically to get advantage from the grazing in the forests?—I would rather not offer an opinion on that point.

182. Then we come to the section of your memorandum on Marketing, and I think you will agree with me that it is idle to proceed to attempt an analysis of the marketing system at present in vogue in India until facts and figures are before us?—Yes.

183. Apparently those facts and figures have never yet been ascertained; is that the position?—I believe it is the position, but I have written to the Local Governments on the subject and have asked them to give special attention to the points raised by you in your questionnaire; they are, I take it, collecting the information now and will have it ready by the time they get the questionnaire.

184. When we get those materials we may find it possible, I do not say we shall find it possible, to build up and analyse the price structure and make some appreciation of the cash aspect of marketing?—Yes.

185. Do you think the producer of the raw material is getting his fair share of the good things of the world, not only in India but all over the world to-day?—I think not.

186. Compared with industrial organisations, farming in the nature of things is an industry carried on by small units?—Yes, it is.

187. And in these days you find the purchasers of raw material acting in large combinations, highly efficient and highly organised. It is extremely difficult, is it not, to get cultivators to combine adequately and sufficiently for the purpose of protecting their interests when they are selling their produce?—It is very difficult, and the middlemen put difficulties in the way of Government starting any such organisation.

188. And it is no use combining the more efficient units, the larger farmers, the more wealthy cultivators, if the smaller man remains unorganised, because the produce placed on the market by the small man breaks the market in spite of the organisation of the more important farmers?—Yes, quite; but Government can establish markets and the smaller man as well as the bigger man can take advantage of these markets. I refer to markets such as the open cotton markets in Berar.

189. But to turn again to the general aspect of things, it remains true that the producer of the essential raw materials, if he realised his power and could be brought to combine, is in a very strong position, does it not? If he could be brought into adequate combination to protect his interest he would be in a very strong position. Do you think his failure to get his fair share of the wealth of the world to-day may be one of the factors tending to rural depopulation, to the drift of population from rural centres to industrial and urban areas?—I do not think we have reason to complain of rural depopulation in India or of any great drift of population from rural to urban areas.

190. But you are at an earlier stage, if I may say so. Do you not think the difficulty of keeping the educated sons of cultivators in their villages is the first sign of what is likely to be a growing tendency to move from the rural area and from the business of cultivation towards the towns and towards industrial employment?—No, I think it is due rather to the fact that agriculture as an industry is not looked on as an industry suitable for educated men in India.

191. You do not think the movement is due to economic causes?—I do not think so.

191A. Where combination between cultivators has not been achieved by co-operation, is an alternative market an important consideration?—I think so.

192. Does the provision of alternative markets in India depend very largely upon the improvement of communications?—Yes; it does, I think.

193. On Question 24, Attracting Capital, advertisement goes for a good deal in these matters. Do you think there has been a quickening of interest in agricultural matters since the Reforms of 1919?—I do not think so. There has been a quickening of interest within the last five or six months.

194. Are you paying us a compliment?—This interest is partly due to the fact that we have this Royal Commission no doubt, but it is due to a greater extent to the fact that our new Viceroy is taking a personal interest in agriculture. That, I think, is the main cause.

195. I want to ask you whether you think that discussions in the legislative bodies have quickened public interest?—Not in the Central Provinces most certainly, where I was Director. Discussions relating to agriculture generally took place when our annual Budget was under consideration; the members of the Council sometimes cut it down despite the fact that Government was quite prepared to sanction it. They were only interested, in other words, in keeping down expenditure.

196. I was concerned not with the attitude of members but rather with the effect of their words on persons outside?—I do not think our Legislative Councils have as yet taken much interest in agriculture. In our Councils we have very few members who do.

197. Now on your answer to the question about the welfare of the rural population, does much remain of the indigenous village organisation which must, I suppose, have existed in India as in other Oriental countries?—I think something still remains, but there have been great changes.

198. Would it be advisable to strengthen the village organisation or the village unit?—You mean, to have panchayets?

199. I do?—They have done a good deal in some Provinces, I think, to resuscitate the panchayet system. They have put a man on special duty. I notice in the Central Provinces to organise such panchayets.

200. Do you think that is a wise endeavour?—I think it is very wise.

201. Now on quite a different matter, statistics show that the population of British India has tended to rise at least as rapidly as the productivity of the soil and the total wealth produced by cultivators has tended to increase?—Yes, that is so.

202. And if every increase in fertility and in the output of agricultural produce is met by an increase in the population is there likely to be any raising of the standard of living?—I do not think there really can be much, unless some form of birth control is practised.

203. Very early marriage of course is another cause, is it not?—Yes, that is the main cause.

204. Do you think that the spread of education is likely to have any effect in checking the rising birth rate?—I think it should.

205. Am I right in thinking that the Imperial Department is responsible for agricultural questions and for the administration of agricultural matters in the small isolated administrative units such as Coorg and Ajmer-Merwara?—I am afraid they seldom ask us for assistance. We have given a good deal of assistance to the Department in the North-West Frontier Province.

206. They have no provincial organisation, naturally?—No, but in the North-West Frontier Province they do have a small department.

207. Do you suggest that you should wait till they ask before you give?—We are not supposed to offer our services except through the Political Department.

208. I do not suggest any lapse of duty of course, but I was wondering whether in your view the cultivators in these areas were receiving the same attention as the cultivators in other areas?—No, I do not think they are.

209. Do you feel yourself that you and your department are having placed before you the results of research work in other countries, particularly in the Empire outside British India?—We get all their publications. We have a very large library at Pusa and we get publications from all parts of the Empire as well as from countries outside the Empire.

210. You do not think that anything more has to be done in the way of inter-communication?—I do not think so.

211. If I might take you back for one moment, I forgot to ask you, but it strikes me very forcibly that there is no Department of Agricultural Economy at Pusa. Why is that?—We have not felt the need of it up to date; but we have this year appointed an Agronomist.

212. Do you attempt to carry out systems of costings?—I am afraid we have not given much attention to costings up to date.

213. Do you agree with me that costings are coming to be regarded as one of the most important factors in progressive agriculture?—Yes; it should be very important in the Provinces, but Pusa is a research station. The receipts there are very, very small, needless to say; we are spending money on research but are getting very little back.

214. That is an explanation of why you cannot afford another department?—There is less material, I mean, at Pusa, than in the Provinces for the study of rural economics.

215. Is it your view that there is no scope for a department of this nature, a department of agricultural economy at Pusa?—If the Provinces desired it there would be room. I should like to point out however that the Provinces do not come to the Imperial Department for help to the same extent as they used to do.

216. Is that in part due to the fact that the central department does not provide them with that which they require?—No. It is largely due to the fact that provincial departments are now more or less self-contained, and require less assistance from Pusa.

217. One last question on a rather different matter: Do you think it would be to the advantage of agriculture if factories could be established in rural areas rather than that new factories should all be congregated in the present industrial districts?—I think it would. It would supply labour for the surplus population. We already have a certain number of factories in rural areas which provide labour for a good many thousands of people.

218. Have you ever considered the possibility of the development of hydro-electrical schemes on a large scale in relation to this question?—I think that little has been done in that direction in India. They are considering it, I believe, in the United Provinces. There has been nothing done up to date, as far as I know.

219. Do you happen to know who in the Government of India could tell us about hydro-electric possibilities?—The man who would be able to tell you is Mr. Harris who will be giving evidence this week.

220. There used to be an officer responsible for hydro-electric schemes, at any rate for hydro-electric surveys: I understand that has been discontinued?—Yes, I think Mr. Harris is responsible at the present time.

221. But you feel that future developments of this sort might have a most important bearing on agriculture generally?—It might well be.

222. *Dr. Hyder*: In regard to this question of research and co-ordination of agricultural activity, I ask you whether there is any research at present being carried on in the Provinces?—There is a good deal of research being carried on in the Provinces at present.

223. So there are research institutes under the Central Government and also in the Provinces?—Yes, that is so.

224. You think you require co-ordination between these different institutes?—I do.

225. What is your agency? How do you propose to give effect to this idea?—I propose to have an Advisory Council, the members of which would be appointed by the Government of India acting in consultation with Provincial Governments. This Advisory Council would make recommendations regarding schemes of work to be taken up. The Council would get these schemes of work carried out through committees appointed *ad hoc* as we have appointed a Cotton Committee to carry out work in the improvement of cotton; separate Committees would have to be appointed for the improvement of different crops, such as tobacco, wheat, sugarcane, etc., and the Government of India would have to find all the money required. The money would be spent in this way; the Advisory Council would make certain recommendations regarding research work to be done by its own staffs; it would probably advise that additional staff should be recruited. The Advisory Council would also give grants to provincial agricultural departments working on similar problems. As the Central Cotton Committee finances its own farms and finances as well the research work being done on cotton by provincial departments so would each committee of the Advisory Council allot grants both for the work done by its own men and for the work done by research workers in the Provinces.

226. And these workers would be under the control of the Provincial Governments or of the Central Government?—In some cases they would be

under the Central Government; in cases where the Central Government had its own station in a Province, the research workers of that station would be under the Central Government. On the other hand when, on the advice of the council, a man in a Province was deputed to work on a certain problem, he should remain under his Director of Agriculture, I think.

227. You do not think any conflicts will arise between the present provincial autonomy in certain transferred subjects and the idea of central control?—I do not think so, for the reason that we have had a good deal of experience in administering the Central Cotton Committee; there has been no friction. If the Council provided the money there would be no objection to its carrying on research work in the Provinces.

228. With regard to this Pusa Institute, it is a purely research institute, is it not?—Largely research.

229. It does no teaching?—We provide post-graduate courses and up to the present time we have been giving what we call short courses on special subjects.

230. With regard to the results obtained in this institute, how do you make it certain that these results are actually for the benefit of the cultivator? How do they get down, filter down?—What we do is this: when we evolve a wheat, for example, which we consider to be very good, we first test it at Pusa and then we supply seed to those Departments of Agriculture which are interested in wheat-growing. They test this wheat on their experimental farms. When they find that it is superior to their own they multiply it on their seed farms; and then from their seed farms it is given out to the cultivators. Pusa 4 and Pusa 12 wheat were given out in the first place to the Department of Agriculture in the United Provinces, the Punjab and Bihar and Orissa. The area under these two wheats is reckoned to be about 2 million acres; the Director of Agriculture in the United Provinces states that the area under Pusa wheat in that Province alone is between 600,000 and 700,000 acres.

231. Is it your view then that the organisation by means of which the results tested in the laboratories or in the fields at Pusa are actually brought down to the fields of the cultivators is adequate and complete?—No; I do not think it is quite satisfactory. If you have read over the memorandum submitted by the Cane-growing Expert at Coimbatore, you will have noticed that he states that the arrangement by which he gets his canes tested in the Provinces is not satisfactory. He says that in some Provinces they mix up the names and they cannot tell after a year whether the cane they have got is say Coimbatore 210 or Coimbatore 250; they lose the labels in short.

232. The point I have in mind is this: whether there is any gap between the cultivator and the provincial farm: that is, whether the results handed on by the central institute, say, at the provincial farm, do not filter down quite easily to the cultivators?—I think when they test the seed they hand it on to their private seed farmers.

233. Is there any return flow of information from the fields up to your experimental farms and then on to your central institute, so as to keep your research workers also alive to the needs of the cultivators?—Yes, there is; we get reports from the officers in the Provinces who try our improved seed.

234. But you have no agency of your own?—No.

235. Would you like to have some kind of agency, of the kind they have in America for instance; "extension service" or agents or county agents as they have in South Africa and other countries, people who are constantly travelling from the research institute right down to the fields and then come back with their ideas from the fields and hand them on to the research people?—You mean government officials?

236. Government officials or private agency?—Yes; we do want a staff, I think, to work in the Provinces. We cannot rely on getting our improvements introduced as fast as we would like them to be introduced: so long as we have to rely entirely on provincial departments. They have their own

work to do; as it is they have far too much work and there is always a certain amount of jealousy, needless to say, between the Provinces and Pusa as pointed out by the gentleman who wrote the memorandum on the work being done at Coimbatore.

237. So that there is scope for co-ordination and extension there?—Great scope, I should say. You can see for yourself what progress we have made in that direction through the Indian Central Cotton Committee; since we started we have done a great deal for the improvement of cotton in the Provinces.

238. Now, coming to the question of education, why do you think that agricultural education does not make any headway in British India? I would ask you to confine your remarks to agricultural education in the primary stage?—You must remember that, though there has been much talk about agricultural education of late, there is no system of agricultural education widely adopted in India at present. They have done a little in the Punjab, and something has also been done in the United Provinces and Bombay; but very little has been attempted in the other Provinces.

239. Is there no demand for it?—The reason why little importance is attached to the teaching of nature study in primary schools is that many officers in the Education Department hold that the child is at school for a very few years only, and that there is no time to teach him anything but 3 R's. Agricultural education as given in vernacular middle schools is in its infancy.

240. Do you think that if an agricultural boy were given a certain bias in primary education, the agriculturists would like it or would they think that they know agriculture far better than any teacher teaching their boys in the primary schools?—That is my view, but I know there are a great many people who hold an opposite view. They say that you cannot give a boy a rural bias at this stage except by sacrificing the teaching of the 3 R's.

241. With regard to secondary education, where do you think these boys would be absorbed?—Do you mean the vernacular primary education? My idea of course is to get them back to the land.

242. You know that the unit of operation in India is small, say two or three or five or ten acres. Therefore, if a boy equipped with agricultural knowledge goes back to the land, do you think he will be satisfied with the life of his father, or do you think there will be scope enough for his work?—When trained, he is more likely to adopt a higher standard of cultivation. We should train him with a view to enabling him to make more money and to raise his standard of living.

243. With regard to your agricultural colleges, what do you think could be done with the boys who come out of these colleges?—As far as I know the men who have passed through our agricultural colleges have almost all got suitable employment.

244. What I mean is this. In the Agricultural Services, the number of officers who retire or die is much smaller than the number of men turned out by the various agricultural schools and colleges. Where do you think room could be found for these boys?—I think that big landowners could find employment for hundreds or even thousands of them. They are employing a certain number as it is, but in future, I believe, they will employ more men who have been trained at our colleges.

245. With regard to the question of drift from rural areas to towns, do you think this problem in India is the same as in England?—I do not think there is much drift.

246. At present people do come into the towns from rural areas, and the reason is chiefly economic?—Yes, they do go there to get work.

247. So that there is not enough work for all the people in rural areas?—Quite so.

248. There was a question put by the Chairman with regard to the lessening of disease. Do you think that if you lessen the disease it will improve.

the breed or that it will simply preserve the number of the existing inefficient cattle?—I think what the Chairman meant was that there is no encouragement for a man to breed very valuable cattle when they are swept off by rinderpest or some such disease; I think that disease carries away the good as well as the bad. I do not think, however, that disease is a very serious problem on well-managed farms, for the reason that we can give our cattle immunity against the most virulent of all the diseases, namely rinderpest.

249. You will have to do something more to raise the quality of your cattle besides inoculation?—The percentage of mortality in Government farms is very, very small; it is only about one or two per cent. a year.

250. What are the difficulties in the way of raisers of agricultural produce in regard to combination? Why can they not combine when they market their produce? The purchasers have got their own organisations. Why cannot the producers combine in marketing their produce?—The difficulty is that you have got hundreds of thousands of isolated units who are more or less illiterate; they do not combine in marketing their produce. It is the duty of the Government, therefore, to get them to do it.

251. In order to perform that duty, the first essential then is there must be general education among such people, otherwise they will not be able to combine?—I think they will combine to a certain extent even without education. Education will tend to make them see the advantages of combination, but if you are going to wait for education, you may have to wait for ten or twenty years or for even a longer period.

252. Now, with regard to the business side of farming, you said in reply to the Chairman that there was no Department of Agricultural Economy. The prejudice against Pusa and against all researches carried on on Government farms is that they have got a very long purse, but what we want to see is whether their ideas are sound from a business point of view. Do you think there is need for some such department?—There is certainly need for some such department for India as a whole, but we have got the Auditors coming along every year, and there is very little chance of exceeding our expenditure.

253. That is not in my mind. What I have in mind is this, whether a certain idea which you have worked out in your laboratory and tested on your fields, appeals to the cultivator from the business point of view?—We have no means of testing our improvements. We have to rely on the Provinces to do that.

254. *Sir Thomas Middleton*: In reply to Dr. Hyder you outlined the type of organisation which you had in mind for securing co-ordination in scientific research in India. Now, I think it is obvious that at first some such organisation would be most useful. It follows closely the type of organisation that we have found useful in Great Britain. But I was going to ask you this question. Have you thought whether this type of organisation is likely to be permanently useful in India. Is it as a beginning or is it the permanent type of the organisation which you have in view for co-ordinating the Services?—I think it should be a permanent structure.

255. That is to say, the Government of India should be responsible for research and for financing research, leaving to the Provincial Governments mainly the duty of education. That is the general outline, is it not?—Yes, but the Provinces would also continue to do research as they are doing at present.

256. You have in view the strengthening of the research work in the Provinces just as much as in the stations directly under the Government of India?—We would supplement the work they are doing at present by giving them grants for work on special problems.

257. You refer in the précis of your evidence to the need for the establishment by the Government of India of certain additional research stations controlled by its own officers. I should like to have some more information as to the types of stations you have in view?—You must have noticed that

in the memorandum submitted by the Indian Sugar Producers' Association, they have pointed out that the Government of India should have its own stations for testing the canes evolved at Coimbatore. The Cane-breeding Expert at that station has pointed out the same thing. He says that he cannot always get his new canes tested properly in the Provinces, so what I have in mind is, in cane-growing Provinces such as the United Provinces, we might have at least one small station of say 10 to 20 acres where we could have our canes tested by our own men. We would hand on the cane seed to the local Department of Agriculture, the staff of which would arrange for its distribution.

258. I quite follow that the type of station you have in view is a station for a special crop or a special subject. In advocating these extensions had you in view another type of station, a station which instead of studying a particular crop or a particular subject, would deal with the problems of a locality, for example, the problems that arise in some new canal area? Did it occur to you that additional stations for the study of groups of problems might be required?—Do you mean irrigation problems?

259. The group of problems that might arise in, for example, a newly canalised area. One might instance the question of alkali, the need for studying the rotations suited for, and the crop pests in, the area, that is to say, the provision of a station serving a locality rather than a subject?—I think that stations of that kind would probably be very useful. The Board of Agriculture recommended in 1918, I think it was, that the Government of India should have stations for investigating irrigation problems. But the proposal was turned down: the Government of India held that the Provinces were now getting all the revenue from irrigation, and that the Government of India should not, therefore, find the money. The proposal was strongly supported by the Inspector General of Irrigation with the Government of India.

260. You agree with me that stations of that kind might be required?—I think so.

261. In reply to the Chairman yesterday, you indicated that research might benefit by being associated with education?—That is my own opinion, but a great many men in our department think quite differently.

262. You may agree with me that education would benefit to an even greater degree if associated with research?—Yes, I agree.

263. Is there any difference of opinion on that subject among those engaged in agricultural education?—I think not.

264. All are agreed that education benefits by association with research?—Yes.

265. Now, I am going to ask you this question. You have throughout the Provinces a number of higher institutions doing, as you indicate, in some cases, a certain amount of research. I am going to ask you if it would not be possible to associate with these teaching institutions the groups of problems of the second kind which I have just referred, namely those groups which apply to areas, leaving for the Government of India those special subjects which one might describe as All-India problems. You are probably familiar with the method by which this work is organised in Great Britain. We have our research stations or institutes as we call them there. We have also our provincial colleges which form advisory centres. You may know that the second group of problems to which I have referred are the questions which specially interest our provincial colleges in England. Have you been giving any thought in India to the possibility of directing the researches within the college areas to these general questions?—I do not think much has been done in that direction.

266. You have not reached that stage of organisation?—I do not think so.

267. You agree that a development in that direction would probably be useful for the college?—I think it probably would. If we had an All-India Advisory Council we might get it to allot funds for work to be done by the Provinces on these problems.

268. That brings me to another point. You say that the Government of India should allot the funds. Are you satisfied that the Government of India could always provide funds. May not the position arise in which a Province is better able to afford a special piece of work, which your Advisory Council might think it advisable to undertake, than the Central Government?—The Advisory Council would have to take all that into consideration of course. The Indian Central Cotton Committee refuses to give a grant to a Province for work on cotton, when that grant is required for work for which the Province itself should ordinarily provide funds.

269. That is your present method of dealing with grants. Is that method likely to lead to what we all desire, namely co-operation?—I think it is likely to do so.

270. Do you not agree that the thinking out of the financial relations between the Government of India and the Provinces on this particular subject of the allocation of research wants a good deal of attention?—We would have representatives of the Provinces on this All-India Advisory Council; they would have to be consulted.

271. You would deal with each question as it arises?—Yes, just as we do on the Indian Central Cotton Committee.

272. You would satisfy the representatives of the Provinces that your reason for refusal was simply that the Province was in a better position than you, as a central body, were, to supply the funds?—The Provinces would have to accept the decision of the majority of the Council as they already have to do in the case of similar questions brought before the Indian Central Cotton Committee.

273. There is one very small matter on quite a different subject on which I wanted to ask you a question. You said in reply to the Chairman that you thought that, generally speaking, the results of your fertiliser experiments were reliable and satisfactory. I wanted for my own information to ascertain whether the usual practice is to carry out these tests in duplicate or triplicate. You sent in a tabulated statement, I think it is in the Memorandum on Fertilisers, summarising the results of a large number of experiments. Am I right in supposing that the figures were results of experiments carried out on duplicated plots?—I do not think there has been much duplication, but they are carried on for a period of years and then we strike the averages.

274. It serves much the same purpose?—Yes. I do not mean to say that the results are altogether reliable: in some cases I believe they are not as the land was not standardised before the experiment was started. Taken as a whole, the experiments are fairly reliable.

275. If we allow for a pretty big margin of error in examining these figures you think that they are not likely to mislead us?—Exactly.

276. *Sir Ganga Ram*: On the subject of nitrogen, are you prepared to accept the statement which is made in the book which I read from, the American book, that each acre of wheat land deprives the soil of 180 lbs. of nitrogen, 31 lbs. of potash and 90 lbs. of phosphoric material?—No. I have read the book and have come to the conclusion that the writer added an "0" to it by mistake.

277. You accept those figures?—No, I do not.

278. What modifications would you suggest?—He states on page 21 that the crop of wheat removes from the soil 20 lbs. of nitrogen. Then on page 22 he states that it removes 180 lbs. There must be a mistake in his figures.

279. Robertson puts it down as 90 lbs.?—I have got the figures here. I may tell you that the average crop of wheat in India is 845 lbs. The grain actually removes about 13·7 lbs. of nitrogen per acre and the straw removes about 5·3 lbs., so altogether just about 19 lbs. of nitrogen is removed. This is for a small crop of 845 or 850 lbs. In the Punjab you get twice that yield: a crop there may remove 40 lbs. of nitrogen.

280. I am coming to that. If so much of nitrogen is lost every year, and as we know very little manure is put in, how is the nitrogen brought back

into the soil? If so much nitrogen is removed every year there would be nothing left in the soil. What remedy have you thought out? What is the natural remedy for this?—The natural remedy is to apply organic manure.

281. Where the manure is not supplied, there would be nothing to produce?—A certain amount is being supplied.

282. There are many places where they employ no manure at all?—In that case you have got down to what I call a state of maximum impoverishment.

283. I will tell you what remedy I have found for this. In the Punjab we have found it. I have made experiments on it. Did you read my book on the Punjab Proverbs?—Yes.

284. I learnt it from an ordinary farmer that the more you open the soil, you bring in more nitrogen from the air in the form of nitrifying bacteria. In the Punjab the least average yield is 15 maunds per acre. I have made experiments and found out that by ploughing 20 times I can get 25 maunds and by ploughing 25 times I can get 35 maunds per acre. Do you accept that statement that by constantly ploughing the land you abstract nitrogen from the air into the soil in the form of nitrifying bacteria?—The amount of nitrogen obtained from the air is about $3\frac{1}{2}$ lbs. per acre only. That comes down in the rain and the dew. The reason why you get a much larger crop by better cultivation is that you produce optimum conditions for nitrification. The organic matter is acted upon by the nitrifying bacteria in the soil, which build up a large quantity of nitrate. By experiments carried out in India it has been proved that in five months the amount of nitrogen in the soil can be increased by 50 per cent.; in other words, that you can increase the amount of nitrogen per acre in the first nine inches of soil by something like 3,000 lbs., which is about 100 times as much as the crop removes. The quantity of nitrogen in the soil is increasing and decreasing from season to season.

285. You accept this natural method which we have found out in the Punjab? I have made inquiries from other Provinces. They plough only five times and they only got 6 maunds per acre?—I understand your line of reasoning; but the reason why you get more is not due to the fact that the nitrogen comes from the air. You get a bigger yield because in the soil aerated by much ploughing you have produced optimum conditions for the nitrifying bacteria.

286. You accept the natural method?—Yes, I accept it.

287. On page 1, you say that your research work has been handicapped by the fact that the Board is given no funds and no executive powers. Will you define what executive powers you want?—I mean that we would require funds to enable us to carry out localised research in the Provinces.

288. You say that you are handicapped for want of executive powers?—As a Board we have no executive powers in the Provinces. The Board as such is only an advisory body. It advises Government to adopt schemes of improvement, but having no money placed at its disposal it cannot give effect to its own recommendations.

289. I only want the word "executive" to be defined?—By "executive powers" I mean power to give effect to its own recommendations, to start its own stations and to employ its own research workers if need be.

290. In what way would the Board control matters in the Province?—If it had its own stations; it would control them, in the same way as the Cotton Committee is controlling the Indore Institute.

291. In Provinces how would you control?—We would have our own men in charge of any station we opened.

292. In each Province?—Only in Provinces in which we opened stations.

293. Do you also wish to have central control over the Services?—No, I did not anticipate that.

294. Could you give any indication of the funds you would require?—For all purposes, we would probably require about a crore of rupees at least.

295. Will a crore satisfy you?—Yes, I think it would.

296. And also the Provinces?—The Provinces would provide their own money in their several budgets.

297. You require this money for your central research?—For central research and for supplementing such research as is already being done by the Provinces.

298. Out of that money you would give a slice to the Provinces?—Yes.

299. In that case, would you allow the constitution of the Board to remain as it is, or would you want to have any modification?—We would have to change the constitution. We would require an Advisory Body with committees working under that Advisory Body. So, the constitution would be very fundamentally changed.

300. In what way would the provincial research be differentiated from the Imperial? Would their work in some cases not be overlapping?—In many cases it is very desirable that we should have overlapping. We would duplicate, at the commencement, in some cases, but the Advisory Council would have to see that there was no undue overlapping.

301. Do you attach any value to the wisdom inculcated in the proverbs of the people?—I attach a good deal of importance to them, but I think that an expert who takes up the study of a question like this does consider indigenous theories such as those incorporated in proverbs.

302. Would you use these proverbs in any shape in the syllabus of rural schools?—No, I do not think I would go as far as that. We sometimes publish articles in the Agricultural Journal giving such proverbs and thus bring them to the notice of the people.

303. Do you give salt to cows?—Always.

304. How much?—We do not as a rule measure it out because we have what we call salt licks and the cows are allowed to lick as much as they want.

305. And horses?—We do not keep any horses.

306. You think it is necessary to give salt to cattle?—I think so. We do it on all Government farms.

307. We should devise some method of making it available to zamindars?—You can get salt in the villages in a solid form.

308. At page 3 you say that the education given in agricultural colleges is very cheap. Is it cheaper than the education in the Arts and Science and Medical Colleges?—I think it is, but I cannot give you figures. I know that in the Central Provinces we used to charge a fee of Rs. 3 a month, and that I consider cheap.

309. Do you think if the cost of agricultural education was higher that it would deter people from adopting the agricultural profession?—It would not deter fairly well-to-do people.

310. I understand that the present standard of admission into agricultural colleges is the matriculation. Would you propose any higher standard?—The standard varies from Province to Province.

311. Do you think if the standard was raised to the F. A. the students would be better able to follow the lectures?—Yes, I think they would, but if we were to raise the standard, fewer students would apply for admission.

312. You say that education in rural areas should be made practical. Can you explain the present deficiency of it?—At the present time, agriculture is not included in the curriculum of vernacular middle schools except in the case of some 60 schools in the Punjab, some 30 in Bombay and about the same number in the Central Provinces.

313. To what extent is agriculture financed by (1) co-operative societies, (2) the Government *taccavi* loans, and (3) village money-lenders? I understand that the co-operative societies have been pushed forward in this country

for the last 20 years and yet we find that this method had not reached far enough and agriculture is as a whole being financed very largely by the money-lenders? What is the cause? Is it that our co-operative movement has not become so popular as we should have desired? Why do the cultivators in most cases still prefer the money-lenders, although the interest charged by them is greater than that charged by the co-operative societies? Is it not due to the fact that the village money-lender is more accommodating and less rigid in his attitude than the co-operative society?—I think that is a leading question. I am inclined to agree with you.

314. Then in that case do you know that 90 per cent. of the money advanced to the agriculturist is given by money-lenders? Would you not in these circumstances improve the indigenous banking system and utilise that agency for the promotion and development of agriculture?—Yes. I have suggested that in my reply to one of the questionnaire on the improvement of the indigenous banking system.

315. Could not the Imperial Bank, for instance, advance money on very favourable terms to the co-operative societies and thereby enable the latter to reduce the interest to the agricultural people? Would that not be a method?—It may be, but I do not profess to know very much about these questions.

316. You say that one of the causes of the present agricultural indebtedness is the great pressure of the population on the soil. Can you tell us in which particular parts of the country that is so?—Mainly in the Provinces in which the holdings are very small such as Bengal, Bihar and Orissa, and the United Provinces, where there are many holdings of only 2 or 3 acres or less.

317. As far as that goes, in the Punjab, according to Mr. Calvert's figures, there are 17,000 people holding one acre each?—I think the holdings are still smaller in Bihar and Orissa and Bengal.

318. And in Bombay?—No, I do not think they are smaller there than in the Punjab.

319. Do you think that that means that we should frame some rules or law to prohibit further fragmentation? Have you any ideas on the subject?—I do not think it would be advisable to frame any such rule. I think it is a good thing to have in rural areas small cultivators who put in a certain amount of their time as labourers.

320. But it does not give them a living wage?—Well, in that case they try to get work outside.

321. What do you think is the proper size of an agricultural holding in three kinds of land, irrigated area, well-irrigated and unirrigated area, which should give a man a living wage for himself and his family?—It is very difficult to answer that question, but I should put it at 10 to 12 acres in the case of irrigated land and at 19 to 20 in the case of unirrigated land.

322. And you would make no difference between "irrigated by canal" and "irrigated by well"?—No.

323. In regard to the question which the Chairman asked you about soil survey, would you include also a survey of the section of the land, I mean, the spring level of the land? While you are doing the survey, would you also include the survey of the spring level of the land, the water level, the spring level at which by digging a well you get water?—Well, I have, in replying to a certain question in the questionnaire, suggested that a survey of the subsoil water should be made in the Provinces as recommended by the Board of Agriculture.

324. I mean a general survey of the country showing the water level?—I think that survey should be carried out as an entirely separate piece of work, and not as part of a soil survey.

325. But it is very necessary?—I think so.

326. You think that the spring level generally follows the contour of the country, or is it parallel to the contour of the country, the general lie of the

country?—It might be parallel in the Gangetic alluvium but it certainly is not so in Peninsular India.

327. Because that is not parallel to the country: are you aware of any rule about it?—No.

328. Otherwise it would give rise to something like the *kaerez* system as in Baluchistan, that is, they generally go on digging a well until the water comes to the level of the country?—That is what they generally do.

329. *Dr. Hyder*: It has got to be lifted up.

Sir Ganga Ram: No. It is the *kaerez* system; generally, the spring level is not parallel to the country; it follows different lines altogether. I will be able to explain that better afterwards; that is the reason why I wanted the evidence of Mr. Wilsdon who has got some knowledge on that question.

330. You know that in certain parts of America and in certain parts of Europe also, the double size of the economical holding is made inalienable by law?—Yes.

331. Would you, for the purpose of keeping model farms for the instruction of the general masses of the country, introduce the English law of entail on big estates which are self-acquired if the proprietors of such estates want this law to be applied?—I am afraid I have not considered the question.

332. Perhaps you are aware of the fact that this option is already given to *jagirdars* of the Punjab, I do not know about other Provinces?—Yes.

333. *Jagirdars* in the Punjab are given the option of entailing their property and make it inalienable?—Yes.

334. Is it a fact that in some parts of the country irrigation canals are not remunerative except in cases of drought?—Yes.

335. Have you thought of any scheme such as tube wells on a co-operative basis? It is stated in the Irrigation Commission's report that in the United Provinces the Canals Department always pray for drought to make the canals pay. The great demand for water is in the months of April, May and June. When the rains start, there is no demand for water, and in the hope of getting rain, they do not take canal water in the beginning; but when drought comes there is too much pressure on the Canal Department for water. Do you think a system of tube wells for three months working on a co-operative basis and giving water for three months would be available to stimulate sugarcane cultivation?—It may be. It would depend on the cost of lifting the water.

336. You say in your statement that the erosion of soil in many parts of the country should be prevented by embankment. Have you thought of any scheme for the purpose? Have you seen my article on the subject?—Yes, I have read your article.

337. What is your opinion regarding the suggestion made in that article, that is to say, to make it compulsory on the part of every proprietor not to leave the land unploughed?—The suggestion may be sound enough, but I do not like the idea of forcing the cultivator to adopt improvements.

338. Could you suggest any practical schemes for construction of embankments, drainage of water-logged areas and reclamation of soils, destruction of weeds and prevention of soil erosion? Have you thought of these very important questions?—These are all questions which would naturally be taken up by the Advisory Council which I propose to constitute. Each question would be discussed by men who understand it, such as Engineers and Agriculturists. We had, as a Board of Agriculture, advised Government to appoint an Engineer to go into the question of embanking and draining land, but this Engineer has never been appointed.

339. Have you any idea of any mineral deposits in the country which could by some chemical process be converted into fertilizers in British India as well as in Indian States?—You will find that Dr. Pascoe's memorandum gives a great deal of information regarding the deposits of mineral phosphates and saltpetre available in India.

340. You know that sulphur plays a very important part in converting bones into superphosphates and also in other agricultural matters. Are you aware of any raw material from which we could get sulphur in this country?—At present we import our sulphur from Japan.

Professor Gangulee: And from Sicily.

341. *Sir Ganga Ram*: What about iron pyrites?—I think that in his memorandum Dr. Pascoe refers to the possibility of getting sulphur in Burma.

342. I am told that there is iron pyrites in Gwalior?—I am afraid I do not know.

343. Would you be in favour of levying an export duty on bones?—I would put on a small duty on the understanding that the money was to be utilised in demonstrating improved methods of cultivation involving the use of manures.

344. The money to be spent on factories to convert bones into superphosphates?—Not with the idea of prohibiting the export of manures.

345. In reply to the Chairman you said that night-soil is not very important. Are you aware of the fact that in the Punjab land which is within 25 acres of the village always carried 25 to 50 per cent. more price?—I know that. The same applies more or less to every village in India.

346. Within 20 acres of the village habitation the price is certainly 25 per cent. more than elsewhere?—Yes. What I think the Chairman meant, however, was that it might be possible to convey large quantities of poudrette from the bigger towns to the villages.

347. That is made by burning night-soil?—No, it is the name applied to night-soil when dried and decomposed. The night-soil is put into pits and left for a year or so and by bacterial action it is converted into dry earthy matter known as poudrette.

348. In regard to cheap fuel to be used in the place of cow dung, the Forest Department claim that an increase of forestry is the proper substitution and therefore there should be increase of forest. I am going to ask the Forest Department if they know of any tree which will not cast any injurious shadow on the crops when planted round the fields. That is the only way to substitute cheap fuel for cow dung and I have tried it. When the Commission come to my village I will show them. I do not remember the name of the tree, but I have got 4 trees. I planted the whole square of 25 acres with that and they prove very good. In three years they gave 1 maund and 29 seers of fuel. It is a kind of Eucalyptus. It was suggested to me by the late Mr. Booth Tucker. Are you aware of any tree of that kind?—I think you mean the Australian Blue Gum or Eucalyptus which they have in the Nilgiris.

349. Is it not injurious to the crops growing underneath?—To a certain extent; but it is not so injurious as some trees.

350. If the tree is very tall, even if it is injurious the shadow would be only for a short period?—It has less foliage than most trees, and the shadow is not large.

351. Have you any other suggestions to make in regard to providing cheap fuel to the cultivators?—I have made some suggestions in my replies to the questionnaire. I have suggested that we should get fuel reserves established wherever possible near the villages.

352. No zamindar will buy. He will not spend a pice if he can help it. Unless he can get something very cheap, or without paying for it, he will revert to cow dung. The only remedy is to plant that kind of Eucalyptus on the edge of the holdings. Have you analysed the soil of Bombay? Is it owing to the nature of the soil that the yield of Bombay for sugarcane is three times that of the United Provinces?—The soil of the Bombay Presidency is not so rich as that of the United Provinces, but in Bombay cane-growers supply

an enormous quantity of manure to their cane. They spend up to Rs. 300 or even Rs. 400 an acre on manure.

353. Is that increase only due to manure?—Entirely.

354. It is not due to any superiority of soil?—It is partly due to the fact that they grow thick canes, and thick canes when heavily manured give bigger yields than thin varieties.

355. *Dr. Hyder*: They pay the highest water rate?—Yes, up to Rs. 60 per acre.

356. *Sir Ganga Ram*: In order to stimulate the use of seeds, do you not think the agency of *patwaris* might be invited?—We have never had any trouble in getting rid of all the good seed we produced. The demand is great already; there is no need to stimulate that demand.

357. Do you admit one statement which is made in the book I lent you? Do you think if the soil does not suit the seed, the seed must be altered to suit the soil? Is that true?—Yes, but you must remember that that book was not written by a scientist. It was written by a propagandist.

358. I wanted to know whether you were prepared to admit that?—That only means that in a soil that is not suitable for a crop which is late in maturing, an early variety should be sown which will mature before the soil loses its moisture.

359. They have very little wheat in Bombay. They have not even sufficient for the people. They import wheat from other Provinces. Cannot you invent some seed to suit that soil?—There is a Pusa wheat known as Pusa No. 4, which matures about a month earlier than most wheats grown in Northern India.

360. To prevent the destruction of crops by wild animals, would you advise Government to put up Canadian fencing round large areas? It would be impossible to fence each field because the cost would be prohibitive?—It should be quite possible to get all the village cultivators to combine in putting up a fence round the whole village.

361. Could not Government do it, and charge them something?—They are fencing villages now in the Bombay Presidency, I understand; the people themselves are, I gather, meeting the cost.

362. Do you recognize the fact that in order to grow valuable crops, all the land available has come under cultivation and very little is left for the purpose of cattle grazing? Since there is a recognised need for a larger supply of other dairying produce, what is your opinion with regard to the suggestion that in the case of landholders owning more than 25 acres of land they should by law be prohibited from cultivating more than 75 per cent. and the remaining 25 per cent. should be left for grazing? In the Punjab they have passed rules to that effect?—I think it would be quite a mistake to do so; the grass obtained from an acre does not weigh out to more than 600 or 700 pounds when dried, whereas wheat will give a yield of straw weighing at least 1,000 pounds, and *juar* much more.

363. But in the Punjab they have reduced the irrigation water. They only give water just enough for 75 per cent. On the advice of the Agricultural Department they have made the rule that people should not do 100 per cent. of cultivation?—Still, I do not think it pays to put land under grass in this country.

364. I am not talking about grass. If they only plough the land, herbs and other things will grow, which will be enough for grazing?—It gives you very little in the way of return.

365. What is your opinion about stimulating the oil crops in order to keep the cake here for the purpose of manuring and to set up the practice of hydrogenation by which you could use this oil for the purpose of railway grease or for any other use of oil that you can think of?—I do not think that is a question that the Royal Commission on Agriculture should take up; the Industrial Commission dealt with it.

366. Could not the Commission recommend that such a practice should be established so that it will stimulate the growth of oil-seeds and therefore keep the cake in the country for purposes of manures? It will come within the purview of the Commission from that point of view?—I doubt whether this Commission is qualified to deal with a question of that kind.

367. In the Punjab we find that the donkey is a very useful animal for the purpose of marketing. Do you not think some effort should be made to improve the breed of donkeys? By castration, and so on?—I am very sorry, but I do not know very much about donkeys.

368. What are at present the subsidiary occupations in rural areas? Have you thought of any schemes? You know that in the unirrigated parts of the Bombay Presidency there is no occupation for the people for about 4 months in the year?—I believe that is correct.

369. Could you suggest some occupations like dairy farming, poultry keeping, bee-keeping, etc.?—I have said in replying to the questionnaire that poultry keeping and dairying are suitable subsidiary industries for the cultivator.

370. You recognise that in the time of famine, the dearth of fodder creates more havoc than the dearth of grain. What scheme have you thought of to keep one year's reserve of fodder? Is it by pressing or by keeping in silos?—By storing fodder in silos and stacks.

371. By pressing fodder or keeping it in silage?—In both ways.

372. Could the grass that grows on the banks of canals be rendered fit for cattle by any process of keeping it in silage?—It makes a fairly good silage. I do not know what kind of grass you mean, but we have made silage of the ordinary coarse grasses.

373. At present the products of our schools and colleges mostly adopt literary and clerical professions which are non-productive. As far as the economics of the country are concerned, it also adds to the problem of unemployment. Do you not think agriculture should be introduced in schools from very early stages whether the students take to the agricultural profession or not?—It should be introduced in rural schools only; not in urban schools.

374. Would there be any harm if you introduce agriculture as an optional subject in urban schools also? There are many subjects which are never made use of, such as zoology and a good many other subjects?—I think it would be advisable to do much more than has been done in this direction for rural schools before starting in urban schools.

375. Have you any definite opinion about the cash rent versus *batai*, which means participation in kind?—I do not think that *batai* is a suitable system; it offers to the *batai* cultivator no great incentive to produce a big crop. He only gets one-half of the crop whether it is big or small.

376. On the other hand, when the landlord takes only cash, there is no incentive for him to improve his estate?—When the landlord takes cash, he knows that the cash rent is fixed, whether he produces a big crop or not.

377. Therefore, it makes him lazy. I can tell you that in the Punjab colonies there is nothing but the *batai* system and people have become very very rich in a very short time.—Perhaps they are all good tenants.

378. You say the average villager is satisfied with a low standard of living and does not try to improve the conditions under which his forefathers were content to live. Here again, do you not think that the elimination of educated and well-to-do people from rural areas has deprived the country of leaders of thought who could set an example in public health, sanitation and hygienic living?—I agree with you that if we had educated men in the villages they would help to raise the standard of living.

379. Really the standard of living depends upon means. I may tell you that since the war in Lahore we are producing now 100 tons of ice whereas before the war only six or seven tons of ice used to suffice. No coolie will drink water now without ice in it. The wages of coolies have gone up from

3 annas within 10 years to 12 annas and 14 annas. I do not know what is the case in other Provinces?—The cost of labour has risen all over India, though probably not to that extent.

380. *Sir Henry Lawrence*: You told us just now that you would like to have a sum of about a crore of rupees at the disposal of the Imperial Department. What is your present budget?—The present budget is between 9 and 10 lakhs.

381. Has that been reduced? Was it bigger in recent years?—It has not been reduced within the last two or three years, but it has not grown, either.

382. Would you like to have a progressive increase up to something like a crore?—Yes. We had proposed to add considerably to the staff of the Imperial Department, but the Inchcape Committee made recommendations to the effect that we should curtail our expenditure and we have not filled some of the posts which were sanctioned.

383. You have been forced to curtail your expenditure?—We have been prevented from expanding the department. That is probably the better way of putting it.

384. Can you tell me roughly the expenditure in provincial departments all over India?—I think the total net expenditure on agriculture last year was 82 lakhs. That is for all-India, including the Imperial Department.

385. If you are to go up ten-fold, would you ask the Provinces to go up in similar proportion?—The idea would be to utilise part of the crore in the Provinces. The Advisory Council would make grants to the Provinces for certain lines of research which they would carry out.

386. Then you wish to centralise the work more than it is at present?—Yes.

387. How do you reconcile this with the devolution to Provinces of financial autonomy and also with the fact that agriculture is a transferred subject?—We would not interfere with the working of the departments in the Provinces. It would be a case of making grants to provincial departments and of the Government of India carrying on certain lines of research work as they do at present but on a larger scale. At the present time the Cotton Committee is giving grants to the Provinces and is to some extent controlling the work being done on cotton in the Provinces.

388. You do not suggest that your scheme would require any alteration of the system established under the Government of India Act?—I do not think so. The Provinces would only object in the case of our interfering with their staff or if we were to ask them to undertake research work without our finding the money for it.

389. You do not think that any alteration of the Devolution Rules would be necessary?—No, I do not think that any alteration would be necessary.

390. And under the Devolution Rules research in agriculture is definitely assigned to the Provinces?—Yes, but the Central Government is also supposed to carry out research.

391. You see no obstacle?—It has not been definitely laid down that the Central Government should carry out only certain lines of research and that other lines should be left to the Provinces. In my opinion the Imperial Department of Agriculture should expand and intensify its research work and also help the Provinces to intensify and expand theirs.

392. And that system would be accepted, so far as you know, by the Ministers of Agriculture in the Provinces?—I think it would be. I have discussed the proposal with some Directors of Agriculture who agreed that it would work all right.

393. Have you discussed it with any Ministers of Agriculture?—I have, informally. We were to have discussed this whole question at the last meeting of the Board of Agriculture; the Government of India, however, issued orders about 3 weeks before the Board met to the effect that the subject should be removed from the agenda of the Board, as it would be considered by this Royal Commission.

394. I understood you to suggest that there is not so much co-ordination as existed say five or six years ago between the different Provinces and the Imperial Department.—Yes, that is so.

395. To what do you attribute that?—I think it is due to the fact that agriculture is now a transferred subject.

396. But is that any reason why they should not accept or invite your assistance and advice?—If you read the Devolution Rules you will find that they do not imply that the Central Government should co-ordinate the work in the Provinces. The Agricultural Adviser to the Central Government is no longer responsible for the work done in the Provinces. The Provinces seldom consult him. If you have read Mr. Ware's memorandum you will have noticed that he states that in veterinary matters too there is no co-ordination of work between Muktesar and the Provinces. This is what he says:—

“There is very little correspondence or connection between the Muktesar Institute and the provincial Veterinary Departments. Pieces of research work have been carried out at this Institute at the instigation of provincial Veterinary Departments and occasionally advice is sought by them, but in nearly every case this can be traced to some personal arrangement. There is no other means of co-ordinating the work of this Institute and that of the Provinces with the result that there is little co-ordination or co-operation. In at least one case there was distinct friction as a result of what a Province considered intrusion by this Institute in the matter of investigating a disease.”

397. Yes; I see that was the experience at Muktesar, but I wanted to know if your experience at Pusa was similar?—Our experience at Pusa is similar to some extent, though some Provinces do get all the assistance they can from us, for instance, Bengal, North-West Frontier Province, Bihar and Orissa, and to a less extent the Punjab.

398. Then I understand, owing to this lack of power of co-ordination vesting in your hands, there has been some overlapping of research work in the different Provinces. Is that your view?—Yes, I think so.

399. Could you give us any instances of what kind of work is being duplicated without good reason or good results?—Take the work now being done on a disease such as wilt in cotton, they are working on it in Bombay and they are working on it in the Central Provinces.

400. Cannot those two work together and check one another? Is it not useful or is it something that you want to stop?—No, a certain amount of duplication is necessary, but there is no means of finding out what these two different Provinces are really doing or how they are tackling such problems. We get their reports, but the work they are doing is not fully described in these reports. We used to meet together once a year as a Board of Agriculture and discuss the research work being done in the Provinces, but these meetings are now being held only once in two years. Moreover, there is very little touring between one Province and another: it is very, very seldom that an officer is allowed to go to other Provinces to see what is being done there. The tendency, as you perhaps know, has been to cut down expenditure on touring. The Provinces have been passing through a period of financial stringency and so has the Government of India.

401. I would like to have that clearer. Do you suggest that the Provinces refuse to pay the touring expenses of an Imperial officer; is that it?—A Province would refuse to pay the touring expenses of its own officers who wanted to go to other Provinces: Provincial Governments refuse also to pay the touring expenses of Imperial officers who have occasion to visit their Provinces.

402. Would that not be a proper charge on your own budget?—Well, there again the Government of India think that a Province should in certain cases at least pay the touring expenses of Imperial Service officers. For instance, when we send down an officer from Pusa to examine the students of an agricultural college, say, the Agricultural College at Nagpur, we expect the Central Provinces to pay his travelling allowances.

403. Then you really suggest that important work in agriculture had been handicapped and obstacles interposed by these petty financial difficulties about charging touring expenses?—Certainly.

404. You have instances to support that?—Yes; in the memorandum written by Dr. MacCrae, the Mycologist at Pusa, you will notice that he says that the reason why the Provinces do not welcome the officers of the Imperial Department is that they are afraid they will have to pay their travelling allowances.

405. I hope you will not be able to produce any such instances of petty-mindedness on behalf of the Government of Bombay! I hope not; I do not know of any?—Before going to Bombay in the middle of March I wrote to Dr. Mann to ask whether he would like to discuss questions with me seeing that I was passing through Poona. He replied to say that he did not think there was any question he wanted to discuss with me. I was paying my own travelling allowance.

406. That is rather a different point, is it not?—But that shows that the Imperial officers are not really wanted in the Provinces, or in some Provinces.

407. Yes, I see. Now, coming to a different point, I understand that your department has suffered certain losses owing to retirement of officers. Is there any general reason for that dissatisfaction; are they dissatisfied with their prospects, or what?—You mean officers serving under the Government of India?

408. I want to know to whom you refer. You spoke of the loss of certain Imperial officers owing to retirement?—We call all the officers in the Indian Agricultural Service Imperial officers whether they work in the Provinces or not. Yes, we have lost quite a number of them; they became dissatisfied with the conditions under which they had to serve.

409. Was that in matters of pay or what?—Yes, pay, and in some Provinces they were subjected to unfair criticism in the Legislative Councils.

410. Would you trace that to the introduction of the Reforms?—Yes, it was at least partly due to the introduction of the Reforms.

411. You told us also that you were sometimes unable to get agricultural officers from the Provinces to work at Pusa?—Yes.

412. That is hard to reconcile with your other statement?—I do not think so; if an officer comes to Pusa he can rise to be head of a section. His pay as such rises to Rs. 1,950 only. In a Province he can rise to be Director of Agriculture, in which case he gets Rs. 2,000 to start with. Another reason is this; if an officer comes from the Provinces to Pusa he has to serve under the Government of India, and in the event of his wanting to retire on proportionate pension he is not allowed to do so. If he remains in his Province he enjoys the privilege of being allowed to retire on proportionate pension if need be.

413. Then do you suggest that the emoluments of officers at Pusa under the Imperial Government should be increased?—I think they ought to be increased, otherwise we shall certainly not get good men for Pusa from the Provinces.

414. Then I think you said there had been no recruitment of European officers in the last few years. Does your Department recruit European officers direct?—No, there is no direct recruitment. Mr. Milligan, my predecessor, selected a man three years ago for a post at Pusa, but the Advisory Committee on Agriculture to the Legislative Assembly refused to agree to his being appointed on the terms proposed. They said they were prepared to recommend his being taken on for a period of 3 or 5 years to train an Indian. The man we had selected refused to come on a short term agreement.

415. Then there has been some reference made to the question of sugarcane. Have you any reason to suppose that the importation of sugar is damaging the cultivation of sugarcane in this country?—I do not think so. The duty on sugar at the present time works out to about 40 per cent. With a duty

of 40 per cent. in favour of the sugar-grower in India, I think, the industry requires no further protection.

416. Does that 40 per cent. keep out imports of Java sugar?—The quantity of Java and other sugar imported last year was about 722,000 tons; the duty does not keep it out, still the sugar factories in this country should do quite well with sugar at its present price.

417. What proportion of the sugar consumed in the country is produced by the factories?—Well, over 800,000 tons were consumed last year, of which the factories produced 90,000 tons.

418. That is, chiefly sugar from sugar-cane?—Do you mean *gur*?

419. The total sugar consumed in the country?—The total quantity of sugar of all kinds made in India last year was just under 3 million tons, of which 90,000 tons was white or factory sugar; but we had to import 722,000 tons of white or factory-made sugar.

420. So the factory product is about 3 per cent. of the total consumption?—Yes, about that.

421. *The Raju of Purlakimedi*: May I know whether any experiments are being conducted at Pusa for the maximum yield of paddy?—No, the land at Pusa is not suitable for rice and there is no rice being grown there.

422. I thought it was an Imperial Research Institute?—Yes; but we concentrate on crops which can be grown with advantage at Pusa.

423. But have you not got information as to what are the best manures suited to paddy from Provincial Governments?—Yes; we have got a lot of information about that; they are using cattle manure everywhere and also green manure on a fairly large scale, and sometimes *sann*-hemp; and in some Provinces they are trying artificial manures such as sulphate of ammonia, but only on a small scale.

424. Do you not think that a mixture of bonemeal and green manure will produce a good deal of paddy?—Yes, that mixture has given quite good results in some Provinces.

425. Do you think that *dhaincha* is a better green manure than *sann*-hemp?—It is not better as regards quality but it gives a much bigger yield; *sann*-hemp is a faster grower and gives a bigger growth early in the season; so there is that advantage to be considered. On the other hand *dhaincha* is almost a semi-aquatic plant; it grows freely on water-logged land.

426. But *sann*-hemp is also a fibrous plant, is it not?—Yes.

427. So it can be grown to better advantage as a fibrous plant instead of using it as a green manure crop?—You can use it for both really; you can use the leaf as green manure and the stem of the same crop for fibre.

428. But does not *dhaincha* serve as a fibrous plant?—No.

429. As regards Indian cattle what improvements would you suggest to get the maximum yield of milk from different varieties available? Would you prefer the selection system or cross-breeding system?—Selection by all means. Cross-breeding is only feasible and practicable where you have a dairy from which you are supplying milk to a big town, and where you destroy your male calves.

430. Is cross-breeding between English and Indian cattle in the long run a success or a failure?—I think it has been distinctly a success on the Military dairy farms; by cross-breeding they have raised the yield of milk from say roughly 6 to 7 thousand lbs., which may be taken as the very best yield obtainable from an improved Indian cow in a lactation, to 12,000 lbs.

431. Is it not a fact that these cross-bred animals are more susceptible to diseases than the native ones?—Yes, that is so; but then you can give immunity against rinderpest to the cross-bred in the same way as you give immunity to the indigenous animal: rinderpest is the chief disease we have to guard against; the other diseases are not so important.

432. I think the climatic conditions also go against it as the cross-bred becomes purer, do they not?—The first cross only is useful; you produce the

first cross and you stop there; if you produce a three-quarter cross then the animal loses constitution.

433. It cannot stand the heat?—It cannot stand the heat.

434. So do you not think cross-breeding between selected varieties of Indian cattle would prove better?—I think there is probably room for both systems; where you want to produce large quantities of milk very cheaply for the towns, cross-breeding with English breeds is feasible. The Military Department has been breeding dairy cows for over thirty years, and they have stuck to their system of cross-breeding with the Ayrshire and Holsteir breeds. They find that by crossing they can produce a cow that gives twice as much milk as a good Indian cow.

435. What are the commercial crops on which research is being undertaken in Pusa? I mean to say the crops having a commercial value?—Tobacco, sugar-cane, wheat, chillies and several others.

436. Have these research varieties of tobacco been tried in Southern India?—Yes; the Pusa varieties are being tried at Guntur in Madras where the Imperial Tobacco Company are growing tobaccos.

437. Is it a drought-resisting variety?—No; it requires about the same amount of moisture as the ordinary *deshi* kinds, I understand.

438. But I suppose the variety of leaf produced is a much better type?—Yes; the variety evolved by Mr. Howard at Pusa and known as No. 28 gives a much better leaf than the ordinary country tobaccos.

439. Is it by experimenting, as with, say the seeds of sugar-cane, by a sort of inter-fertilisation with flowers that you get a better variety?—Both ways; No. 28 Pusa was a straight selection; but we have produced quite a number of cross-bred varieties at Pusa by crossing *deshi* tobaccos with improved American varieties.

440. Which is most suitable?—The crosses that we have under observation are promising but we have not had time to test them thoroughly. It takes quite a number of years to fix such crosses; still they are very promising. The Manager of the Imperial Tobacco Company says that the leaf is very good.

441. They are better than the selections, are they?—Better to this extent that you can sell the tobacco at about eight annas a pound, while the ordinary country tobacco fetches about three or four annas.

442. *Sir James MacKenna*: Yesterday in reply to the Chairman and this afternoon in answer to Sir Henry Lawrence you have given what I may call the material considerations which prevent officers in the Provinces coming on to the Imperial staff at Pusa. Are there any other reasons with which you may be acquainted which make it difficult to attract probably your best men to Pusa?—Another difficulty of course is that officers in the Provinces have opportunities for touring; they have a freer life; at Pusa they are tied down to one place; they are very isolated there.

443. That is a semi-material consideration. Have you considered cases which came to your notice as Agricultural Adviser where one either failed to get, or with great difficulty persuaded a man working at a particular problem in a Province to go to Pusa because that man was sacrificing his work?—There is something in that no doubt; but I do not think that is very important, for after all they know quite well that they will get work of great importance to do at Pusa. We did try to get a Botanist from the Provinces two years ago, but he refused to come to us; he said his prospects were much better in Bengal.

444. Therefore there is a risk that on the grounds of material considerations and the higher consideration which I have suggested, you may have some difficulty in getting the best men?—Yes; we tried but failed to get a man from the Central Provinces quite lately.

445. There is a serious risk that the Pusa staff might become somewhat second rate?—Undoubtedly it will.

446. Does that tend to strengthen the position of Pusa as a centre for Imperial research?—No.

447. What other reasons can you mention as preventing officers going to Pusa?—I have mentioned them; there is the question of pay and there is the question of being very isolated; and there is the question of not having opportunities for touring and seeing what other workers are doing. I may add also that the climate from July till about the middle of October is not at all good; it is not so good as it is in most Provinces.

448. Do you think there is room for duplication of an institute similar to Pusa in Southern India to deal with wet crops and rice crops to which it is not possible to devote so much attention at Pusa?—You mean, a station that would be run by the central Government?

449. Yes?—Under my scheme, we would have such stations scattered all over India. We already have a cane-breeding station in Southern India. We would require to have a rice station either in Madras or Bengal I suppose; and we would probably require to have a wheat station either in Jubbulpore or Northern India.

450. Yes, that would meet the case. There was a good deal of talk about lack of co-ordination and failure to co-operate and co-ordinate between Pusa and the Provinces. Do you not think that this is probably largely due to the fact that provincial departments are so much better-manned and that therefore references are not as numerous as they used to be when Provinces did not have their own entomologists and mycologists and bacteriologists?—Yes; I think it is very largely due to that. Some of them now have very good chemical and botanical sections. The provincial departments which do apply to us most frequently for assistance are those which have not got entomologists and mycologists.

451. In view of all these circumstances it seems that if Pusa is to maintain its position as head of our agricultural research, it must be manned by men of the very highest calibre who have made their reputation in agricultural research?—I agree entirely.

452. The staff must be very carefully selected and trained?—Yes, I think it is a mistake to insist on Indianising Pusa; it is quite a mistake.

453. Coming to that question of Indianisation on another line: the policy, of course, of the Government of India is that the Services should be completely Indianised and there should be no recruitment from Europe at all. Have any steps been taken to provide the necessary higher agricultural education to train these future research workers and teachers?—We have made provision at Pusa, but our staff there is not sufficiently strong to give really good courses.

454. Do you think that the imposition of teaching work of the higher grade upon the heads of sections would handicap research?—It would; we would require two good men for each section, so that one of the two could devote part of his time to teaching.

455. That is the point I wanted to get. Then, I presume that, if this Central Advisory Board, or whatever you call it, comes into being, you contemplate that the Pusa Institution should be under that Board?—I think so.

456. Also the one at Muktesar?—All the work we are doing there should also come under it.

457. What about the Central Cotton Committee?—It is a going concern. It is doing very well. I do not quite see how we could bring this under the Central Advisory Board.

458. Then there is a general question about agricultural organisation. You have been in the Agricultural Department practically since its inception, and, as you know, the principle adopted there was to divide the country by administrative areas; that is to say, a large area was placed under Deputy Directors of Agriculture, corresponding roughly to a Commissioner's Division. But do you not think it would have been a better policy from the beginning if we had divided up by crops rather than dividing the country by geographical area, and got men to work on one crop?—In the Central Provinces we divided our Province for administrative purposes into what we called the wheat tract, the rice tract and the cotton tract, and we did follow

that system more or less. We had men for work on definite crops. One worked on wheat, another worked on cotton, and a third worked on rice.

459. You think that is a better system?—I think so. It encourages some measure of specialisation and concentration.

460. I have one or two general questions. You are strongly in favour of an agricultural bias in education?—Yes, but I may be wrong.

461. Was there any agricultural bias in your education?—I was brought up on the land. I worked on the land for a time.

462. Then another question. I am just trying to pick up what has been left out in the exhaustive examination. You are very enthusiastic about simultaneous inoculation against rinderpest?—I think it should be introduced on a large scale as soon as we can find the staff in the Provinces to carry it into effect.

463. You admit that it is a very ticklish job?—Yes, but the percentages of deaths now are something below one per cent., about a half per cent.

464. Very good. Just another subsidiary matter with reference to agricultural economics which was mentioned. Do you know whether provincial colleges include in their courses a training in farm accounts, book-keeping, the Civil Service Regulations and that sort of thing?—Some of our colleges teach these subjects.

465. Do you think it is a very desirable subject?—Yes. Our colleges should give instructions in costings, and the activities of the co-operative movement in India.

466. *Professor Gangulec*: You are Agricultural Adviser to the Government of India, and you are also the Director of Research Stations?—Yes, I am.

467. What are your duties as Agricultural Adviser to the Government of India?—As Agricultural Adviser, I give the Government advice on questions referred to me, and when the Provinces ask for advice, I advise them. I am in charge of the Coimbatore cane-breeding institution, of the Institute of Animal Husbandry and Dairying at Bangalore and of the Wellington, Bangalore and Karnal farms. I am also in administrative charge of the Muktesar Research Institute, and I am *ex-officio* President of the Indian Central Cotton Committee. I am also responsible for the editing of all the publications emanating from Pusa, including all the Memoirs and Bulletins and the Agricultural Journal.

468. And you are also the Director of Research Stations?—Yes.

469. Do you conduct any field experiments yourself or any research work?—No, I have no time for research.

470. Do you chart out a plan of research for others?—No, we have a definite plan that was drawn up several years ago by the Pusa Council.

471. Do you have time to make inquiries as to what extent researches are being developed and what progress is being made?—It is being done in consultation with the heads of sections from time to time.

472. Have you visited any central research stations in Europe?—I am afraid I have not.

473. Have you visited the famous Rothamsted experimental station of England?—No. I have visited some in Scotland.

474. Have you visited the Rowett Research Institute at Aberdeen?—Yes.

475. What do you think of the laboratory equipment of the Pusa Institute as compared with the equipment of the institutions you have visited in Great Britain?—I think that of the Pusa Institute is quite as good as that of those at Home.

476. Have you any information about the salaries of research workers in different parts of England in comparison with what you propose to give your research workers in Pusa?—I have a fair idea. I know we pay them a great deal more out here than we do at Home, because the men will not come out unless they get at least twice as much in India as they get at Home.

Even when we pay them twice as much, they do not always care to stay out here.

477. What problems of fundamental importance have been tackled during the last five years in Pusa?—If you take the trouble to read through our reports, you will find that all the problems tackled are described therein in great detail.

478. I am referring to this. We have an excellent result out of Dr. Howard's work, Pusa No. 12. Since then what problems of fundamental importance with reference to animal nutrition or plant nutrition, animal protection or plant protection, have been tackled?—We have lately evolved wheats which are probably as good as Pusa 4 and 12. We have, for example, Nos. 54 and 55 which have been evolved within the last few years; these are being given out to the Provinces. As regards animal nutrition, if you will take the trouble to read through Mr. Warth's reports, you will see what work is being done by him at Bangalore.

479. I am referring to problems of fundamental importance, for instance, with regard to manuring problems which are not merely of local importance, but are likely to be of all-India importance?—Do you not consider nutrition problems as being of fundamental importance?

480. Do the provincial research workers visit Pusa?—At the time of the Board meetings. They come, that is, once in two years. Men from Bengal and Bihar and Orissa very often come at other times.

481. They come even now?—Yes, we had the Director of Agriculture from Bengal there only last week.

482. Do you visit experimental stations?—I do at times.

483. What is the object of your visit? Do you direct their work or make inquiries?—I am not supposed to do that. I visit the stations when they ask me to.

484. Now, please tell us something about the meetings of the Board of Agriculture. You discuss there all-India Agricultural problems, do you?—Yes, on consultation with the Board of Agriculture I decide on the subjects that are to be discussed. I think we have sent you copies of the proceedings for the last year, and also copies of the resolutions passed by the Board since 1905. If you will take the trouble to read through the resolutions, you will get a fair idea of the work done at our meetings.

485. I was impressed with various suggestions made at the Board of Agriculture meetings, and therefore I am asking you as to what extent the suggestions made by the Board of Agriculture have been followed either by the Provinces or by the Imperial Department?—I have tried, as far as possible, to explain in a memorandum submitted what action has been taken on the different resolutions. In a good many cases we have not been able to take action for want of money.

486. What reasons, then, have you to expect that an all-India organisation which you suggest would furnish provincial departments with added stimulus to agricultural and veterinary researches. You have suggested the Advisory Council. What reasons have you to expect that this organisation which you propose would furnish additional stimulus to agriculture?—We already have one central body, namely, the Indian Central Cotton Committee, which has been a great success; we should have other committees for work on other all-India problems. The Cotton Committee has been a great success. It has been tried and tested and has proved a success.

487. You go on the precedent of the Cotton Committee? Do you realise that cotton is a special subject, has specific vested interests behind it?—Yes, it has to a great extent, but there are other crops, for instance, sugarcane, tobacco, and wheat, the improvement of which might well be treated in the same way.

488. Perhaps I am repeating a question which was already put to you by Sir James MacKenna. What specific agricultural research problems have been investigated by the Central Department at Pusa to which the provincial departments have not paid attention?—The provincial departments have not

given much attention to crop diseases, for instance; very few of them have mycologists. They have given very little attention to the study of insect pests for the same reason. They have given little or no attention to bacteriology; they have not got bacteriologists.

489. Are there any handicaps to agricultural research being conducted by the provincial departments? You have just said that they have not got bacteriologists or mycologists?—They have been suffering from want of funds in the same way as the central department. That is the main difficulty.

490. You agree that Provinces have made certain progress during the last decade?—Very good progress.

491. In view of these developments in the Provinces, what changes do you think are necessary in the policy pursued by the Imperial Department?—I have tried to explain in my replies to questions Nos. 1 and 4.

492. I want to be quite clear on the point. Supposing to-day good sense prevails on the Bengal Government and they get a mycologist and carry on research work on mycology. They then perhaps would not feel the necessity of asking your advice on any specific question of mycology? Or supposing in time to come the deficiencies which now exist in the provincial research departments are remedied, then what would be the position of the Imperial Department?—I think you will find in the United States of America, where they have been devoting attention to agriculture for many years, the State departments still have to come to the Federal department for assistance. Is that not so? Then take the International Institute of Agriculture in Rome; experts from all parts of the world attend its conferences to discuss problems in which they are interested. Individual workers do not rely entirely on their own unaided efforts. They are seekers after truth, and as such get valuable information at these conferences from other scientists. They get each others' publications relating to agricultural research too. If you were to get a mycologist for Bengal, after three, four or five years' work, he would still have a lot to learn from Pusa.

493. Therefore I suggest that changes may be necessary in the policy of Pusa as a central research institution as the departments in Provinces develop?—Quite.

494. Sir Henry Lawrence has already asked you several questions on co-ordination. We are all anxious to have that co-ordination. You have said that the Devolution Rules under the Government of India have greatly jeopardised that co-ordination. It is not quite clear to me how these political re-adjustments may affect the scientific work. I find that co-ordination exists between the French scientific workers and workers in Scotland, for instance. Can you explain to us how these actually affect co-ordination? Take, for instance, men engaged in plant breeding experiments. Why do they not come to you and why do you not go to them? How do these Devolution Rules stand in the way?—The Provinces are supposed to be independent of the Government of India. Agriculture is a transferred subject. The Government of India is no longer responsible for the development of agriculture in the Provinces.

495. Supposing that the Province of Bengal were handed over to the French Government to-day, even then I suppose there would be co-ordination between the workers in Bengal and workers in the British Indian territory so far as scientific work is concerned?—I have just pointed out that there is always the risk of the Provinces being asked now to pay all the travelling expenses of a man sent from Pusa to help them in carrying out an investigation. They object to that. Under the old regime there was no such difficulty. We sent the men here and there; our aim was to help the Provinces. We were to some extent at least held responsible for the work in the Provinces.

496. In the last week I received an invitation from the International Soil Science Conference. They are having a meeting at Harpenden in Hertfordshire. Men from all parts of the world are coming there to discuss the problem of soils. Do you organise in India any such conference of workers,

for instance of plant breeders of the different Provinces?—Yes, we do. We hold meetings of specialists, of chemists and mycologists, for example, and we invite the men from the Provinces to attend these meetings. But some of the Provinces think that it costs too much to send their men to Pusa; they are not prepared to pay their travelling allowances.

497. If any provisions are made to satisfy that requirement and to provide funds for such conferences, then you will be satisfied?—Yes. We would like the Provinces to allow their men to attend such conferences.

498. Let me please turn to other questions. Do you propose to develop Pusa as the centre of higher education in agriculture?—I think it should be developed as a centre for post-graduate research courses.

499. Already it is a success? You find the applications more than you can entertain?—Yes. I just mentioned a case yesterday in which we had 16 applications for a post in the chemical section for post-graduate training.

500. What is the standard that you specify?—M.Sc.

501. You find that they have not enough fundamental training in science?—Well, a few of them have, but very few. I do not think there was any M.Sc. in Chemistry who applied this year. They were nearly all B.Sc.'s.

502. Have you been able to develop what we call a research atmosphere in Pusa?—I think so. Our men in the Provincial Service are quite keen on research; I mean our class II or Provincial Service men.

503. You entertain great hopes for Pusa as an agricultural training institution?—I think so. But it will take a long time to establish in India what we may call a scientific atmosphere. There is no real scientific atmosphere in India at present except in Government institutions and Universities. It does not exist in rural areas; in towns it exists to some extent, perhaps.

504. Do you think that higher agricultural training should be in the hands of the Universities?—No.

505. You do not think so?—Not at the present time. It may after a time be placed in the hands of the Universities, but not at present for the reason that we are training men mainly for Government Service and the Department of Agriculture can train them much better than the Universities.

506. The reason for my suggesting that is this. The University having facilities for the teaching of fundamental sciences like chemistry, physics, botany and so forth may supply necessary pre-requisites to agricultural training. Would you not therefore link up the University with a scheme for an advanced agricultural training?—As the Universities happen to be in the bigger towns that divorces their outlook from the practical side of agricultural training.

507. Just as they have developed, for instance, a School of Agriculture at Cambridge University or Oxford University. Practically all the Universities at Home have Faculties of Agriculture?—Conditions are rather different at Home. A very large number of men who take degrees in agriculture at Home are men from the farms. They have acquired all the practical training required before they come to the University.

508. That brings me to the practical question of training young men in agriculture. Do you believe that agricultural pursuits may be raised to the status of a profession in India?—I think so, if the bigger landowners will take an interest in it.

508A. You think you can interest the landowners?—Yes.

509. Turning to the question of State-aid, do you think that the people of this country as a whole obtain sufficient help from the Government in agriculture?—Government has done a great deal for agriculture. They have constructed canals, roads and railways. They have thus spent crores and crores of rupees, whereas the bigger landowners have failed to play their part.

510. Since when have you devoted some attention to the question of cattle-breeding? Do you agree that this is of vital importance to Indian agriculture?—Yes. The Military Department started their cattle-breeding dairies

about 35 years ago; Departments of Agriculture have devoted a certain amount of attention to cattle-breeding for the last 25 years, but they have devoted special attention to it during the last 12 years.

511. When did you appoint your Imperial Dairy Expert?—In 1919.

512. Before that did you carry on any fundamental work?—We had before that our big cattle-breeding farm at Pusa.

513. Was there an expert in charge of that farm?—We had an Imperial Agriculturist in charge.

514. Not a specialist?—Yes, a specialist.

515. What method do you suggest for conserving fodder and forage?—Stacking outside can be done to a certain extent: it can be stacked in barns where they can be put up economically. It can also be conserved as silage in silo pits: the making of silage has great possibilities in India, more especially if made in an ordinary *kutchra* silo pit which costs very little.

516. Are you conducting any experiment in silage to determine its keeping quality?—Yes. We make a very large quantity at Pusa. Our cattle are fed for about half the year on a diet of silage combined with other bulky fodders.

517. You consider that soil survey is of very great importance?—I am afraid I do not attach very much importance to soil surveys, but when we get an adequate staff we should take up such work.

518. Do you think that a beginning could be made in this direction with some co-operation with the Geological Survey of India?—I am not sure how far they have studied the question; but I do not think they devote much attention to soils.

519. Could we have some sort of co-operative method of doing that work with them?—Could you suggest how it could be done?

520. Do you think it could be done?—I do not know that it could be done. They are interested more in rocks and minerals of economic value.

521. How do you carry on your manurial experiments without sufficient knowledge of the soils of the Province?—We possess fairly accurate knowledge of the soils in the Provinces. They have all been carefully analysed mechanically and chemically. Before manures are tried, the land selected for experiment is cropped with one crop; we ascertain whether the land is uniform by weighing that crop. We only carry out our experiments as a rule on land that has been standardized; in other words, on land that we know to be uniform as regards fertility. I do not think that there is any information lacking regarding the soils on Government farms. We know exactly what their chemical and mechanical composition is.

522. The reason why I ask you this question is this. Supposing you recommend the use of sulphate of ammonia. You may not be quite sure whether that soil is likely to benefit?—We have got our chemical analyses of soils which are published with the annual farm reports as a rule.

523. *Mr. Calvert*: I should like to clear up one question by Professor Gangulee. There is no objection from your point of view to an M.Sc. passed student, who wants to appear for his D.Sc., coming to Pusa? How long would it take?—About two years' research work. I think we could arrange that.

524. Is it possible in Provinces to obtain any help in the solution of your specialised problems by co-ordinating work with the post-graduate course and professorships in Universities in subjects like botany, zoology, chemistry, physics, etc.?—We sometimes allow Professors of Universities to take courses at Pusa: they come as a rule during the holidays and for short periods of two or three months.

525. Is the University post-graduate research work helping agriculture at present?—Yes, in so far as they are able to build up our knowledge regarding certain sciences allied to agriculture. That knowledge may be of use to agriculture.

526. I have got a few questions to put you on your note. Under research you do not make any mention of economic research. I presume you do not mean to exclude it?—No, but I think that it should be taken up by the Provinces rather than by Pusa.

527. You say that students who have up to date taken agricultural courses in Agricultural Colleges have been mainly drawn from non-cultivating classes. Would you advocate a restriction in favour of the agricultural students?—I would be in favour of a restriction when the number of agriculturists who apply for admission is greater than the number we can admit. But so long as the supply is not equal to the demand you cannot very well restrict admission only to agriculturists.

528. Then you say that much more attention should be given to the study of agricultural economics at the Agricultural Colleges. Is it not rather a question of over-loading the curriculum?—That may be so, but I think agricultural economics is more important than some of the subjects they teach at present. I would give it the preference: I would leave out, or devote less time to less important subjects with a view to finding time for instruction in rural economics. I have great difficulty in framing questions which I think students can answer for the B.Sc., even though I think they are very elementary. They complain that the curriculum is already so overloaded that they cannot give time to agricultural economics. It is only recently that they have paid much attention to agricultural economics even at Home.

529. In discussing rural schools you say there is a need for the extension of teaching facilities for agricultural subjects and they should be provided at the expense, if necessary, of a purely literary education. I presume you mean literary subjects beyond the three "R's"?—What I really meant was that instead of increasing the number of rural primary schools it might be well to utilise some of the material available for teaching agriculture in vernacular middle schools.

530. But later on in discussing adult education you say it would pay to curtail, if need be, expenditure on less practical forms of education for the time being. You mean in teaching colleges or in the high schools?—In the vernacular middle schools more especially.

531. Would you try to find funds for teaching agriculture in middle schools?—On a large scale and if need be restrict the number of other subjects taught therein. You need not increase the number of primary schools. A great deal of money is being spent on elementary education in the Provinces; the amount spent is increasing every year. I would, if possible, reduce the amount spent on purely literary education and utilise some of it in providing agricultural instruction for vernacular middle schools.

532. You were not referring to the higher Arts courses? It takes about Rs. 200 a year to educate a boy in a technical or arts college and only about Rs. 14 a year in a middle school. You could easily find money for promoting agricultural teaching in middle schools if you curtail the number of arts colleges?—I think there would be a great cry against that, though it is quite a sound idea I admit.

533. Then you say "I doubt whether any appreciable demand for adult education of the literary type is likely to arise in the near future." I think our Punjab figures at present show about 80,000 pupils in rural schools. You were not thinking of that?—I was thinking rather of what had happened in Bombay. Mr. Kamat will be able to tell us what happened there. Although you have got 80,000 pupils it does not necessarily follow that the scheme is intrinsically sound. The temporary success of such a scheme depends too often on the man who initiates it. It is easy, in short, to run a scheme of that kind successfully for a number of years, but when the man who supplies the driving force disappears the whole scheme sometimes collapses.

534. That is, the personal touch?—Yes.

535. I started this movement in the Punjab and so far it has been very successful?—Quite. I have read the account of it given in the Punjab memorandum; the scheme promises very well.

536. I should like to be clear in my mind what exactly you mean by the teaching of agriculture in middle schools. Do you mean the barest elements or something higher?—What they are teaching in the Punjab is some elementary facts regarding soils, improved agricultural implements, crops and so on. You have perhaps seen that little book “Agricultural Lessons on Indian Agriculture.” I think something of that nature is necessary.

537. The Punjab scheme definitely avoids a vocational training?—Yes.

538. It deals with the elementary principles of agriculture?—The idea is to give them a bias; but the special agricultural schools in the Bombay Presidency are definitely vocational.

539. In your note about demonstration and propaganda, you say you would work through the leading landowners and well-to-do cultivators. I gather that in the Central Provinces there are about 2 million cultivators of whom about 1,300,000 would be below the 8·5 acres average. How would you get at these poorer people? Do you think the leading landowner is the right medium?—I think he is the best medium in the Central Provinces. You see the smaller cultivators get their seed from the landowner.

540. Did you try to get at the poorer cultivator direct by any means?—No. We got at them to some extent in this way; we gave out improved seed to the co-operative society of the village; the smaller cultivator, instead of getting a loan in cash, got the loan in seed. When he wanted, say, Rs. 10 worth of cotton seed we supplied that seed and his society paid for it. He got his loan in kind instead of cash, in short.

541. On the question of consolidation of holdings you write rather definitely that complete consolidation would not be desirable even if it were possible. Are you thinking of special conditions?—Yes. I was thinking of the conditions in the Central Provinces. In the villages in the Central Provinces there are very distinct types of soil. For instance, in Chhattisgarh where there are three distinct types, the cultivator would want to have a block in each.

542. Then you would not give that to us as a direction in the Punjab where the Gangetic plain type is very much the same?—I noticed that you were not able to effect complete consolidation. The land quite near the village is much richer than that half a mile away.

543. But the practical advantages of consolidation exceed any advantages of soil?—Yes, but in any one village have you got holdings each in one block?

544. Oh yes, a large number?—I think I pointed out in my note that the difficulties would be much less in the alluvial plains (stretching from the Punjab right down to Bengal) where the soil is more or less uniform in type; but in rolling country with light and heavy soil it is altogether different.

545. Then you say Government should encourage agriculturists to put up joint schemes of land improvement. Have you any suggestions to make? What do you mean by “encourage”?—Government should get co-operative societies to undertake such work.

546. How should Government encourage?—By giving them *taccavi* loans through the central banks.

547. They are doing that now?—To a certain extent, not on a big scale.

548. You were not thinking of any special form of encouragement?—Another form of encouragement would be to place an engineer at their disposal to show them how their enbankments, drainage channels, etc., could best be made.

549. Give free technical advice?—Yes.

550. As regards this question of marketing, would you agree that one of the difficulties in trying to work better marketing systems is that the small cultivator has such small amounts of grain to sell that an improved marketing system would make very little difference to him?—Probably.

551. Encouragement is really insufficient for the small cultivator?—I suppose there is a good deal in that.

552. As regards implements, you say that firms interested in the manufacture of agricultural implements should be encouraged to co-operate with the Imperial and Provincial Departments of Agriculture in evolving improved types. What form of encouragement would you suggest?—I think I have suggested later on that in the event of a firm turning out a very good agricultural implement Government should give a bonus. At present if a firm turns out a very good implement which catches on, it is manufactured by other firms who have not spent a pie in designing or evolving it.

553. You recommend a bonus by Government for evolving implements?—Yes.

554. Further on you say Government should give *taccavi* loans for the purchase of agricultural implements and machinery on a much larger scale than at present. I do not quite understand what the obstacle is?—The obstacle in the Central Provinces was that Government could not provide enough money. We got Government to set aside one lakh of rupees for the purchase of agricultural implements and machinery: they considered that that was quite a big sum; but it was not enough.

555. I suppose there are so many other demands on the money? Later on you propose to encourage stall-feeding; what was the idea there?—To encourage stall-feeding in the villages.

556. Have you got them to store fodder, to encourage them, to show them, to demonstrate the method?—It is just a bit of demonstration. In some Provinces they send round a motor lorry and a fodder cutter and demonstrate in the villages how to make silage. They are actually demonstrating in the villages how fodder can be conserved in the green state as silage, and how dry fodder such as *guar* stalks should be chaffed.

557. Encouragement by demonstration?—Yes.

558. In reply to the Chairman you expressed your opinion in favour of cattle-breeding being under the Director of Agriculture. In the Punjab cattle-breeding is under the Veterinary Department. I think it is the biggest cattle-breeding scheme in India?—Yes.

559. Do you not think it has been very successful?—I think it has been fairly successful though the farm is not run at a profit. In the Punjab you started your Veterinary Department years and years before your Department of Agriculture came into being. But there is not the least doubt but that the agriculturist has far more to do with cattle-breeding than the veterinary man. When in charge of cattle-breeding farms I did not require the help of a veterinary man oftener than once or twice per farm per year. The veterinary man is interested mainly in the diseases of cattle, outbreaks of which occur only after long intervals as a rule; while the agriculturist has to produce the fodder required daily for his herds. On a cattle-breeding farm we do not require the services of the veterinary man oftener than say once or twice in the whole year. In short, the services of the agriculturist are required daily.

560. Would your stock-breeding expert be a veterinary man or an agricultural man?—If he knew something about agriculture, and the growing of crops, and if he knew veterinary science as well, I would prefer the veterinary man.

561. That is a contentious point between the two Departments?—I think every Province except the Punjab has definitely decided that the Director of Agriculture should run cattle-breeding.

Sir James MacKenna: Not Burma.

562. *Mr. Calvert:* A little further on you say it is important to induce landowners to take a keen practical interest in rural matters and you say that to your mind is a question to which the Royal Commission should give special attention. Can you help us with any suggestions?—I think the Royal Commission should recommend that our highest officials in the Provinces should take more interest in agriculture, and that those officials should

use their influence in getting the larger landowners to take more interest in its development. I believe the present Viceroy will be a power for good in the land in that respect; that a great many of our Maharajas, Rajas and Zamindars will, within the next year or two, start home farms, that it is within their power to do a great deal to build up pedigree herds of cattle to produce improved strains of seed and to introduce improved implements, and that their influence and material help would be of great benefit to the cultivator.

563. In your subsidiary industries, you mention fruit-growing, market gardening and poultry-rearing: are there not questions of caste involved in connection with those particular industries?—Poultry-rearing of course might be difficult, but not dairying, I think.

564. You say that the Registrar of Co-operative Societies should be allowed to retain his post for ten years: would you not rather say "encouraged"?—I think that is a better word. It is a mistake to change him every five years or so as often happens.

565. I think you will admit that it is very very important that great care should be taken in selecting the best possible man for the post of Registrar and that he should be kept on as Registrar for a good many years, in the event of his proving a success?—His success would depend very largely on his enthusiasm, I should think.

566. You rather cast some doubts on co-operative cattle-breeding societies?—There are a great many of them in the Punjab.

567. Were you thinking of the Punjab?—No. We had a society in the Central Provinces and we had to close it down. I have not much faith in co-operative cattle-breeding societies. I believe that if we are going to improve cattle in India we must get the owner of the cattle to give them his personal attention. He must take a personal interest in his animals. They have now in some villages premium bulls, each of which is looked after by a certain man in the villages, though its services are given free to all the people of the village. Is that what you mean by co-operative cattle-breeding societies?

568. I mean a co-operative system to organise local public opinion in favour of carrying out the advice of the Department; you are not casting discredit on that?—No.

The Commission then adjourned till 10-30 a.m. on Thursday, the 14th October, 1926.

Thursday, October 14th, 1926.

SIMLA.

PRESENT :

The MARQUESS OF LINLITHGOW, D.L. (*Chairman*).

Sir HENRY STAVELEY LAWRENCE,
K.C.S.I., I.C.S.

Sir THOMAS MIDDLETON, K.B.E.,
C.B.

Rai Bahadur Sir GANGA RAM, Kt.,
C.I.E., M.V.O.

Sir JAMES MACKENNA, Kt., C.I.E.,
I.C.S.

Mr. H. CALVERT, C.I.E., I.C.S.

Raja Sri KRISHNA CHANDRA GAJA-
PATI NARAYANA DEO of Parlaki-
medi.

Professor N. GANGULEE.

Dr. L. K. HYDER.

Mr. B. S. KAMAT.

Mr. J. A. MADAN, I.C.S.

Mr. F. W. H. SMITH.

} (*Joint Secretaries.*)

Dr. D. CLOUSTON, M.A., D.Sc., C.I.E., Agricultural Adviser to the Government of India.

Further Oral Evidence.

569. *Mr. Kamat* : I have to revert to the question as to the lack of co-ordination between the Provinces and the Imperial Department here about which you spoke yesterday, because I feel it is a matter of some importance with reference to the relations, which must be definite, between the Imperial Department and the Provincial Agricultural Departments. Would you, therefore, kindly tell me whether we are to take certain statements which you made yesterday as being symptoms of apathy on the part of the Provincial Departments towards the Imperial Department with regard to co-operation?—To what statements do you refer?

570. You said, for instance, that officers of the Imperial Department were not wanted by the Provinces?—Yes, that applies to certain Provinces.

571. You take that to be a symptom of apathy on the part of the Provincial Departments towards the Imperial Agricultural Department?—Yes, I do.

572. Now this tendency you have noticed during the last 5 years, and you think it was due to, or consequent upon, the introduction of the Reforms?—I think so. It has been due to the fact that the Central Government has now lost all control over the Provincial Departments of Agriculture: we have no strong central body to co-ordinate the activities of the Provincial Departments.

573. I know, but then I am trying to find out whether there are other possible explanations of this lack of co-ordination, because I think it should be the duty of this Commission to take cognisance of any other possible explanations or any other under-currents, and also to ascertain whether the Imperial Agricultural Department is inspiring that confidence and trust which it should deserve. Now you have told me that you have lost control owing to the Reforms. You have read the Devolution Rules and do you not think the Provincial Departments are within their rights in developing their research on their own lines, if they can?—Yes, quite; I agree.

574. Now so far as your personnel is concerned, at any rate in those Provinces where the Director of Agriculture, for instance, is a technical and scientific man, a man of experience, and if he has also in his department men with English qualifications and also Indian qualifications who are able to undertake research, should not they really go on self-contained and on independent lines?—In no part of the world have they been able to make much progress on those lines: you will find that in the United States of America they have found it necessary to have a strong central department to co-ordinate the work of the departments of the different States. You will find the same policy adopted in Australia, and in South Africa: wherever they have a federal system of government they have a strong central Department of Agriculture to co-ordinate the work of their smaller departments.

575. I quite see that you are quoting the analogy of other countries, but, so far as the Devolution Rules go, what has been now provided for, as far as I can see, is that the control which the Central Government can exercise is intended for two things only, namely, if there are differences between two Provinces, if they are unable to settle those differences the Central Government can exercise that control; and, secondly, the Central Government can exercise that control to safeguard its own interests. Otherwise whatever co-ordination there is to be should be on a purely voluntary basis; I mean the Central Government has no right to interfere. Do you agree?—I quite agree. All the same, I think it is wrong. I think that the Central Department should itself do as much for research as possible and at the same time help the Provinces to intensify and expand their research work.

576. Quite so. When you complain of this lack of co-ordination, I want to ask you whether you initiated or laid down any lines along which co-ordination might be made possible between Provinces and yourselves. Did you suggest any lines? I will make my question plainer by means of an example: for instance, did you classify certain subjects which the Provinces could take up for research entirely by their own staff: was any such attempt made to lay down lines along which co-ordination should proceed?—I drew up a scheme which I called a scheme for an All-India organisation for the development of agriculture. I had intended to discuss that scheme at the last meeting of the Board of Agriculture, but, as a result of the decision to appoint a Royal Commission on agriculture, the subject was not discussed.

577. You will have noticed that your scheme does not pertain to research alone, and, secondly, whatever you laid down in this scheme was laid down recently. I am talking about the last 5 years, of which you complain. Have you initiated any lines of co-ordination for the consideration of the Provinces during the last 5 years or since you have been in charge? The Royal Commission only came in at the beginning of this year?—That scheme was drawn up over a year ago, and submitted to the Government of India. We had before that another scheme under consideration; that scheme was to provide for India something corresponding to the Royal Society of Agriculture in England. The Provinces were consulted: some Provinces were in favour of this scheme but others were opposed to it.

578. Beyond the suggestion of this analogy of a Royal Society, there was no effort made by the Government of India to indicate to the Provinces on which lines co-ordination should go?—The Government of India brought into being the Indian Cotton Committee which made very definite recommendations as to how co-ordination could be effected. The Government of India appointed a Sugar Committee too, which made very definite recommendations. All the recommendations of the latter Committee have not been given effect to; it is true, but action has been taken on most of the recommendations of the Cotton Committee. The Government of India has thus made some effort to secure co-ordination.

579. Have you got in your own Department here a list of the problems which the Provincial Departments are trying to solve by research?—The list is a very very large one; you will find them all described in some detail in the reports. I can give you a list if you care to have it.

580. I have got before me at least the list of the Bombay Government. My question was: do you keep the Provinces informed of what the Pusa Research Institute is doing for the time being, and do they keep you informed of the problems they are trying to solve? Is there an interchange in the interests of co-ordination of such problems, so that there should not be overlapping?—Pusa publishes its annual report in which the research work done by the heads of sections is described in considerable detail. The Provinces publish their reports in which their research work is described. Pusa gets reports from the Provinces and the Provinces get the Pusa reports.

581. That is not what I mean. They get the reports after the work is started. I want to know whether before the publication of these reports you are in possession of facts as to what investigations are being carried on in the Provinces and are the Provinces in possession of facts as to what Pusa is doing?—We do not know until the work has actually been taken in hand and until a report on that work has actually been issued.

582. If the Provinces are not kept informed when you take up a particular problem for investigation, how is co-ordination to proceed?—When the Board of Agriculture met annually the programmes of work in the Provinces were discussed. It meets only once in two years now, so it is not possible to keep in touch with the work that is being done in the different Provinces.

583. As the Board does not meet for two years, the respective plans and programmes of research of different Provinces are not known to each other and you have taken no means to ensure that such programmes are made known to the different Provinces. Is that correct?—That is correct, but for that very reason we propose that we should have an All-India organisation to keep the Provinces in touch with Pusa and Pusa with the Provinces. We are trying to remedy the defect.

584. Till that organisation comes into existence, if it does at all, I think this sort of information should be supplied to the Provinces, and if they have not been receiving it, you agree that it is not their fault that there has been lack of co-ordination during the last 5 years? I shall just ask you one question in order to illustrate still further what I indicated. Rice, you know, has various varieties in India. Rice research is circumscribed by conditions of climate and soil. The Bombay Government is carrying on research in one variety of rice. Pusa or other Provinces may be carrying on research about rice. Did you enquire what the Bombay Government was trying to solve and did you inform the Bombay Government what you or the other Provinces were trying to do?—You are pointing out the defects in the present system. As these defects exist I put up a scheme for the better co-ordination of agricultural education and research, but you want to know, evidently, why I did not put up that scheme earlier.

585. I shall now come to another point. Yesterday you told us that it was the shortness of funds for touring and travelling that was perhaps one of the causes of lack of co-ordination?—That is so, to some extent at least.

586. In almost all Provinces the expenditure on agriculture has during the last 10 years, or during the last 5 years, been on the increase?—The increase has been very small: that you will find if you study the budgets.

587. In any case, if there is an outstanding problem which Pusa has solved to the knowledge of the Provincial Governments, they would not grudge the small expenditure to send up their officers to Pusa. They would not be so unwise, would they?—I think it is very possible that they would.

588. If therefore there is unwillingness to spend on travelling, is it due to an under-current of feeling that there is nothing outstanding at Pusa which their officers can learn?—We have been taking on officers from the Provinces for short courses of training and we have repeatedly had as visitors officers from Bengal, Bihar and Orissa and other Provinces.

589. That is not what I meant. Take occasional visits to see what Pusa is doing for tobacco or for sugarcane. Such visits are not encouraged by the Provincial Departments not only owing to the lack of funds but even because

of their feeling perhaps that there is nothing new that they can learn at Pusa? Is that the feeling?—I do not think that that feeling exists.

590. You said something about the calibre of men coming up to Pusa. May I know how many men you have finally selected for the post-graduate course?—You mean this year?

591. This year?—The applications have only come in within the last two or three weeks, but we ordinarily have about 60 applicants, out of which we probably select about 4 or 5.

592. How many post-graduate people have you now working?—We have about a dozen at the present time, I think.

593. Who makes the selection?—We have a selection committee consisting of the Agricultural Adviser and heads of sections at Pusa.

594. Are there any rules for the guidance of this committee, or is the selection purely arbitrary?—Purely arbitrary. We select the best men.

595. You said the other day that there were 16 applicants for the chemistry course out of which none was suitable?—Yes.

596. You know there are other institutions in India for post-graduate courses, such as in Bangalore and the Hindu University at Benares. Do you know that more people go for post-graduate courses to these institutions than to Pusa?—You may be correct. I am not sure.

597. Have you noticed any lack of confidence on the part of candidates going to Pusa rather than to these other institutions where a post-graduate course is provided for?—We have many candidates, but, as I have already said, they have not got the qualifications required.

598. Most of these graduates come from Government colleges, do they not?—From Government colleges.

599. Now, to take one instance, the Royal College of Science in Bombay. If a graduate is trained in a well-equipped college like that, do you think he has not had good training?—His training would probably be all right. We obtain a number of men who have had the necessary training, and whose qualifications are up to our standard. But, as I have already said, a great many of those who apply for admission have not got the qualifications.

600. Is it the fault of the calibre of the boys or is it the equipment or the curriculum?—It is due to the equipment and to the teaching staff provided for these colleges not being up to the standard required.

601. Even in the Government colleges?—Yes.

602. You have nothing to grumble at about the curriculum provided by the Universities, I suppose?—I submitted a note which was a report on the results obtained at Dacca University. Perhaps you have read that. It pointed out the defects in the system. It pointed out that the students were not properly trained in science at the High Schools. The equipment was not good and the staff was not up to the standard required.

603. But men from these Universities, from the very same Government institutions, are accepted in other countries and they turn out to be very good men either in the matter of research or in the matter of general qualifications. Do you know that?—That is so, but at Pusa we also admit a certain number and some of them turn out very well indeed.

604. Then your complaint about the calibre or about the equipment is not shared by other Universities or other educational bodies. Is that correct?—No. It is not correct. The number of Indian students who go home, I suppose, may be a fraction of a per cent. per million of the population. The number is very very small.

605. But no complaint has been received. At least, have you heard any complaint about the calibre or about the bad equipment of the Indian colleges from English Universities?—At Edinburgh University, I know, some Indian students do very well, but quite a number do not. We have the very same experience at Pusa.

606 The English Universities also share your view?—I think so.

607. At least I have not heard of any complaint. You said the other day that you lost very good men in research at Pusa after the introduction of the Reforms?—I did not refer especially to Pusa; I referred to the Provinces.

608. And you told us that it is more or less due to public criticism?—It was partly due to public criticism.

609. Do you mean that these officers who resigned were intolerant of criticism?—It may have been that, because scientific men are intent on their own work and they like to be left alone to do their own work in their own way. They do not like to be criticised by people who do not understand what they are trying to do and who do not understand the time that it takes to produce results by research.

610. By criticism you meant criticism in the Legislative Bodies?—Yes, and in the newspapers.

611. You also told us that members of the Legislative Bodies take very little interest in agriculture?—I was referring in that case to my experience in the Central Provinces. I had a good deal of experience there and I can say without hesitation that they took very little interest in agriculture or agricultural development.

612. How do you reconcile the fact that these officers were intolerant of criticism and therefore had to resign and yet there was very little criticism in the Legislative Bodies of the Agricultural Department or their work?—I think I pointed out that the criticism took place when the budget was being considered and the criticism was destructive criticism. The members did not take much interest in schemes for developing agriculture, constructive proposals, in other words.

613. Take my own Province, which I know fairly well. If members have not been taking interest in agriculture, how would you account for the fact that the budget for the Agricultural Department has gone up during the last 10 years from Rs. 8 to Rs. 15 lakhs?—I am afraid I could not answer your question as I do not know the conditions sufficiently well in the Bombay Presidency.

614. The same phenomenon is to be observed in other Provinces. How is it to be accounted for?—I do know that in the Central Provinces we had our budget reduced by Rs. 1,80,000 in one year by the vote of the Legislative Council and I also know that the reason why they reduced the grant was not their lack of confidence in the Department. It had absolutely nothing to do with the work of the Department. Some of the members of the Council were opposed to a certain measure brought forward by the Minister and to show that they resented this measure they reduced his budget.

615. They might have rejected a particular measure or scheme on its merits. You suggest that generally the members of the Council do not take interest in their own constituencies, which they do not correctly represent?—As far as the Central Provinces are concerned my statement is absolutely correct for the very good reason that the members who represented rural areas were not directly interested in agriculture.

616. As long as they are returned by the rural constituencies, do they not really represent them?—They are representatives in name.

617. Do you know that in certain Provinces rural representatives do not even know English and are allowed to speak in the vernacular and that they are really the representatives of the rural constituencies?—That may be so.

618. You said something yesterday about your views on Indianisation and if I understood you correctly you said that Indianisation was a mistake. Am I correct in saying that?—That is not correct. I may point out here that I am expressing my own personal views. I believe that it is our duty to Indianise as quickly as we can but I also believe that the development of agriculture is of such enormous importance to India that we should recruit for the Central Department of Agriculture the very best men we can get. If necessary we should get our research men from other countries. If, however, we had an appointment vacant for which an Indian and a European had

applied, I would, in the event of their qualifications being equally good, invariably on principle give the appointment to the Indian. But I think it would be a mistake to decide that we shall recruit no more Europeans to the Central Department of Agriculture; we have not yet got a sufficient number of Indians trained to do justice to the research work waiting to be done. Moreover unless we recruit more Europeans of very high calibre, I am afraid we shall not be able to train Indians as they ought to be trained.

619. Then your remarks about Indianisation refer not to the Indianisation in other Departments but only to the Central Department of Agriculture?—I am referring to the Central Department of Agriculture. We cannot interfere with the Provinces.

620. And is it only with reference to research work or with reference to other agricultural work also?—Research and teaching.

621. Now, with regard to the idea that research cannot be done by Indians, is this due to your idea that they have not the genius for research?—I have never made that statement. I have had to train a great many Indians, some of whom have been absolutely first class officers. I have never once cast a slur on Indians or on their ability to do research work. What I said was that they have not yet had an opportunity of learning research methods. The Department of Agriculture is after all only about 20 years old. In some of the Provinces you have not even got the agricultural college at which men can be trained.

622. You recognize, then, that in research Indians have the aptitude for doing good work if they are given the opportunity?—Most certainly they have the aptitude.

623. So far as the research work done in the Provinces is concerned, there have been striking results in certain problems, say, for instance, cotton in Surat and tobacco in Nadia. which have been conducted only by Indian officers of the Agricultural Department?—I should not say that the research work was being conducted entirely by Indian officers, because it is the Director of Agriculture who really controls the research work. With regard to cotton in Surat, I happen to know that the cotton seed that is being given out on a large scale there was evolved over 20 years ago by Professor Gammie.

624. From the annual report of the Director of Agriculture, Bombay. I see that they have evolved locally certain strains of their own. You do not give them the credit for that?—I certainly give them the credit for that, but the improved seed of the Surat cotton to which you have referred was evolved by Gammie.

625. You agree that research in other directions has been done independently by Indian research workers?—They work under the Director of Agriculture, who controls research.

626. You think that without the help of the Director of Agriculture they will not be able to do any work?—I would not make any such statement but I do say that at present they are working under the Director who does control the research work.

627. The Lee Commission has referred to this question and has laid down that so far as the Department of Agriculture is concerned further recruitment as far as possible should be Indian and that there should be Indianisation of the Agricultural Department?—They have made that recommendation, and I quite agree with that. But I say that we should not insist on it for the Imperial Department at least. If we cannot get fully qualified Indians we should not hesitate to get suitable men from Great Britain or from America or from wherever they can be had.

628. If there are Indians capable of being trained in England, you would not send them there and bring them eventually to Pusa?—As a matter of fact, we are already adopting that procedure. We appointed an agronomist quite lately. As he has not got the qualifications required, we propose to send him Home after three years, for training at Cambridge in his special line of work, namely agronomy.

629. If you stretch your eye to the next 15 years, you will be prepared to admit that a certain amount of Indianisation even in the higher appointments at Pusa must be arranged for and the posts must not be reserved only for the European element?—We have made four appointments within the last year and they have all been Indians.

630. As a matter of principle, then, you are not in conflict with the idea of the Lee Commission?—Our goal should be to Indianise the service completely, but I say the time for that has not come yet. We should recruit the very best men available.

631. As a matter of policy, would you not bring that time of Indianisation nearer by taking certain steps?—I think you can bring that time nearer by getting from more advanced countries the most highly trained scientists that they can produce.

632. Would you still carry on that policy of bringing in men from foreign countries instead of sending Indians from here to foreign countries for training?—I would do both simultaneously. If you send a man home, it takes a considerable time to train him there; in the meantime, we should be training Indians out here.

633. Therefore, if you would carry out the policy laid down by the Lee Commission to which the Government of India are also committed, that is not a wrong policy?—It is not a wrong policy, but I think you will find that the Lee Commission did not recommend that the recruitment of Europeans should be stopped; at least, they did not recommend this as far as the Central Department is concerned. It has worked out in practice, however, that European recruitment has been entirely stopped.

634. Would you modify your views, then, that Indianisation is a mistake to that extent?—Complete Indianisation is a mistake. I am not modifying my views. They were my views yesterday.

635. Would you modify your views to the extent that the simultaneous process should go on?—Yes. As a matter of fact, we are already training Indians at Home. For instance, we sent Home men about four years ago to be trained in veterinary science.

636. How many years would you take to accomplish by this simultaneous process the Indianisation of the Pusa Institute; say 20 or 25 years?—I am afraid I cannot tell you that.

637. Would you not attempt it either?—I would not attempt to make a guess as to the time it will take.

638. Gradually?—Yes, gradually, but we are now doing it gradually; we have decided once for all to Indianise the services.

639. You recognize the good work in research which is done by some of the Indian graduates in the Provinces?—Certainly. I have had a great many Indian graduates working under me and some of them have done excellent work.

640. If the visits of the officers from the Pusa Institute were not welcome, is it due to any want of confidence in the work that is carried on there?—No. There are a great many reasons. When we had civilian Directors of Agriculture, they took broader views on the whole, but I do not desire to cast a slur on the work of the expert Director. The expert Director is sometimes inclined to be a little jealous. He wants to get all the credit for the work done in his Province.

641. But this feeling is not confined to Bombay or Madras. You said that it was prevalent in all Provinces?—I said it was prevalent in some other Provinces. I think I stated that some Provinces came to us for assistance. I quoted Bengal and Bihar and Orissa.

642. If there is this feeling it is localised in the Provinces?—Yes, it depends very largely on the personality of the Director.

643. Have any distinctive results been achieved by your workers which have obtained recognition in International journals and International Institutes?—Yes. The work done by the Howards is recognised as most valuable;

it is recognised in every part of the world. You will find that Pusa wheat is now grown on a fairly large scale in Australia even.

644. I am talking of the last few years, since the departure of Howard?—He left Pusa only last year.

645. Then such work has been recognised by International Institutes?—Yes. Our work is often referred to in research journals published in other parts of the world.

646. I now wish to refer to your scheme of an All-India organisation, the rough outline of which you have placed before this Commission. You told Sir Henry Lawrence yesterday that you would accomplish co-ordination by an Advisory Council and also for this All-India organisation I find that you are proposing to have another Advisory Council?—That is correct.

647. Would there not be too much of a multiplication of Advisory Councils in this way?—My proposal was to have one Advisory Council only and have one Executive Committee to carry out the work in the Provinces.

648. But your Advisory Council for co-ordination would be separate from your Advisory Council for this All-India organisation?—No, it is the same thing.

649. It will be within the functions of this All-India organisation to carry out research also?—The Advisory Council would be responsible for that.

650. Would there be no duplication in this way if you leave research within the functions of this body as well?—The Advisory Council would give advice regarding the research work to be done in the Provinces.

651. Now what would be the composition of your Advisory Council, the total composition? Would it run to a hundred members?—No. I have not really thought out the number we should have on the Advisory Council; it might be 30 or 40.

652. You are going to provide for all the Ministers of Agriculture, the Directors and also non-official gentlemen?—No, you are mixing up the two schemes. We were to have in the first place one very big All-India organisation which would include such leading agriculturists as desired to join this organisation. It would also include Ministers of Agriculture, Maharajas, Rajas, and Zemindars interested in agriculture. The aim of this body would be to stimulate a general interest in agriculture, and to get our Legislative Councils to take more interest in agriculture. That body would only meet once a year and would have no advisory functions at all. At its meetings we would have lectures illustrated by slides and cinema films given on different aspects of agricultural development. It would hold an All-India agricultural show once a year; it would have a publication branch and all the members would get the publications issued by the same. In other words, its main aim would be to interest a very large body of people connected with the land in agricultural improvement. It would not have advisory powers. The Advisory Council would be a body within this larger body.

653. Then this larger body would be more or less for propaganda work?—Yes, that is the word.

654. And within that body you wish to have an advisory body?—Yes.

655. I want to know this. When that advisory body tenders advice to the Government, would that advice be binding or would the final word be with the official Adviser to Government?—I think their advice would not be binding, but as the Agricultural Adviser would be chairman of this Advisory Council the chances are that all their recommendations would be accepted by the Government of India.

656. It comes to this, that the recommendations or the resolutions of that Advisory Council will have very little value, as the Agricultural Adviser to the Government has the power to override them?—I am afraid I do not quite follow that. I said the Agricultural Adviser would be chairman of this body, just as he is at present chairman of the Indian Central Cotton Committee. All the recommendations of the Indian Central Cotton Committee, as you know, are sent up to the Government of India and the Government of India

invariably accept them for the reason that their own Agricultural Adviser is President of the Committee.

657. I think you did not catch my point. If the chairman does not agree with the resolutions passed by this Advisory Council, and if he tenders different advice from the resolutions, whose word is to be final?—I do not think that that difficulty is likely to arise in the event of our having such a body.

658. You think it will be a workable body?—Yes, I think so.

659. Have you thought of the funds that might be available for such an organisation as this, without which it cannot be effective?—Yes, I have suggested that the money should be provided either by the Government of India from general revenues, or that a cess should be imposed on certain exports as recommended by Mr. Lindsay, our Trade Commissioner in London.

660. You would derive your resources from a fund that would be created in that way?—Either in the one way or the other. If the Government of India were not in a position to provide the money from general revenues, they could provide it by imposing a cess, and building up a Cess Fund.

661. Earmarked for your All-India organisation?—Yes.

662. You have told us about the federal system existing in the United States of America. There are different bureaux for different kinds of agricultural work attached to the Department at Washington at the headquarters of the Government. I believe in the Union there are something like 35 or 40 States?—I believe there are.

663. These bureaux guide the co-ordination work of these different States. Now is there not some constitutional difference in the arrangements the analogy of which you have given to us, inasmuch as the President of the United States has vast powers and is not dependent on a Cabinet and there is no portfolio for Agriculture there?—I did not recommend that what we may call the federal system of the United States should be followed here in India. I think you are probably referring to a memorandum submitted by Dr. Landor; I did not say that I approved of his suggestions.

664. I take it, then, you would not have a similar arrangement here? You would not approve of it?—Not necessarily.

665. You keep your mind open on that question?—Quite.

666. You would be content with your All-India organisation?—Yes.

667. And no bureaux for investigation?—Well, the committee which has to deal with each crop and each line of research work would really take the place of the bureaux in the federal system in America.

668. *Dr. Hyder*: Did I understand you to say that there was no Secretary for Agriculture in the United States?

Mr. Kamat: I never said that.

669. *Dr. Hyder*: A portfolio, I think you said.

Mr. Kamat: I said a Cabinet system with a portfolio of Agriculture.

670. *Dr. Hyder*: My impression is that these Secretaries correspond to Ministers.

Mr. Kamat: I referred to a Cabinet system with a Minister in charge of a particular portfolio.

671. *Dr. Hyder*: The Secretaries do form part of the Cabinet.

Mr. Kamat: There is a difference: it is not identical with the system in England.

672. Now, *Dr. Clouston*, I have to ask you a few questions about agricultural education. We have heard a great deal about these middle schools and also agricultural bias schools, but let me ask you one question, whether you have during the last few years mapped out a general plan, a general design, of the whole structure, of the whole edifice, if I may call it so, of agricultural education as it should be in each Province? Could you give me a general design of your edifice with an agricultural college for each Province, for instance, as the apex of your edifice and going down to the bottom to the

village?—If you will read over the recommendations of the Board of Agriculture you will find that we have made very definite recommendations.

673. That is precisely the reason I ask the question. I have gone through the recommendations of the Board of Agriculture, but they have not prepared a regular scheme, a whole scheme, of agricultural education beginning from the village right up to the top, the agricultural college, with all the intermediate steps, and a scheme which could be fitted in or dovetailed or combined with the other school systems in the country. That is precisely the point I am driving at. You are aware that in all the Provinces compulsory primary education is being pushed and Acts have been passed. You are also aware that strenuous efforts are being made both by financial and other means to have a large number of schools opened in the villages. We here on this Commission are stressing the point about agricultural education while primary education will also be promoted side by side with it. My point is this: How are the two things to be co-ordinated? Have you thought out a scheme for that?—I think all the co-ordination that is necessary is the co-ordination that has now been adopted in the Punjab, where you add agriculture to the vernacular middle school curriculum. In the primary schools nature study lessons are already being given. I do not think it is really the duty of the Department of Agriculture to undertake to give agricultural education either in primary schools or middle schools. It is the duty of the Education Department. We should act as advisers only.

674. Well then, you agree that according to your scheme in the ordinary rural schools where the three R's are taught, except for nature study you have nothing to do with agricultural education as such?—Nature study in the primary schools.

675. That will be your first step. Then on the top of that you will have middle schools and middle agricultural schools. That will be your second step in the scheme? Is that right?—That is right.

676. Now have you noticed that except in the Punjab, in other Provinces these middle schools have not yet taken root. I mean they have not been a pronounced success?—They have not been started, that is the reason; they have not been tried, except in Bombay and the United Provinces.

677. I was just coming to that. The only other Provinces which have started them are Bombay and the United Provinces. Now in Bombay these have been in existence for something like 12 years?—I think you are mixing up two types of school. You are talking of special schools of the Loni type.

678. Certainly?—But those schools have been tried in Bombay, Bengal, the Central Provinces and Madras. They have not been successful in these provinces.

679. The Loni type of school is only a difference in name. According to your scheme what is the difference?—I think you are probably mixing up the type of education given in the ordinary vernacular middle school in the Punjab schools with that of the special vocational schools of Bombay Presidency.

680. You are therefore in favour of the Punjab type and not of the Loni type. You are not in favour of the policy of separation of purely agricultural schools from others?—I am not in favour of what are called vocational schools. I am in favour of bias schools, as they are called in Bombay.

681. That is altogether different. In the Punjab you are talking of the grafting of these schools on the ordinary school system?—Quite.

682. Do I take your view to be that other Provinces should stop having these separate agricultural schools of the Loni type?—They have been tried in Madras, the Central Provinces and Bengal and they have not done well, and I think I am justified in saying that they have not taken on in the Bombay Presidency, where the first Loni school was started 15 years ago. I think you have at the present time only 6 schools in that very big Presidency.

683. The school at Loni has 42 boys, and another school of the same type at Dhulia has got 22; a total of 64 boys being taught for a population of six millions?—Yes.

684. So you think it would not be workable?—It would not be workable for the reason that you would never be able to find the money required for the extension of this system of education; it costs, I believe, from Rs. 250 to Rs. 300 per pupil per annum.

685. Similarly in Bengal there is one school which has got about 10 or 12 pupils?—Yes. In the Central Provinces we had to close down one of our two vocational schools, and to convert the other into an ordinary vernacular middle school with agriculture as one of the subjects of the curriculum.

686. May I know if during the course of your deliberations in the Board of Agriculture or otherwise you have advised the Provinces to curtail the extension of these special schools and to adopt the Punjab type of school?—We have advised them to adopt the Punjab type, I think.

687. According to your opinion the Provinces are going in the wrong direction spending money over the special schools?—No, I have not said that. We decided at the meeting of the Board of Agriculture held at Poona in 1918 that a certain number of these special schools of the Loni type, *i.e.*, vocational schools, should be opened in each Province. We actually recommended that one or two should be opened in each Province as an experimental measure. Very little money has been wasted on these schools, for after all two only have been opened in Madras, two in the Central Provinces, and one in Bengal. If money has been wasted it has been in Bombay, where there are six such schools.

688. I am just asking you to give the benefit of your views to this Commission with reference to the extension of such schools in the Provinces?—In the light of experience I do not think they should be extended.

689. I want a definite opinion from you as to whether this special type of school should in future or should not be encouraged by the Provinces?—I do not think they should be encouraged.

690. You are definitely of opinion that that type should be given up?—I am definitely of that opinion; if there are many sons of big landowners desirous of getting a scientific training in agriculture, we should provide special courses for such men at our agricultural colleges, where we have all the equipment and staff required.

691. Will you just elaborate to me the kind of instruction given in the Punjab type of school in the middle stage?—They have drawn up a definite syllabus; I have not got a copy of it with me.

692. In all other schools where agriculture is taught, is it an optional subject or a compulsory subject?—I believe it is optional; but all the boys ordinarily take it. I am open to correction and Mr. Calvert will be able to tell us; I believe it is optional, but that all the boys take it.

693. Have you visited these schools in the Punjab yourself?—No, I have not.

694. You have not seen actually the results of the working of these schools?—I have seen the reports on their working.

695. And you are asking us to adopt the Punjab system purely from these reports?—From the reports of men who have had to work these schools.

696. Have you visited the Loni type of schools in Bombay?—I have.

697. *Mr. Kamat:* Till we have better and first hand knowledge of this Punjab type of school, should we not suspend our opinion about the superiority of the Punjab type over the Loni type?

Sir Ganga Ram: Mr. Richey, who started these schools, is coming before you. he will be able to give you information regarding them.

698. *Mr. Kamat:* Until you have satisfied yourself about the superiority of that system of agricultural training, should we not withhold our opinion on it?—I have seen the system as practised in a school in the Central Provinces and I know fairly well how the system is applied in the Punjab.

699. What is your opinion about the agricultural bias schools which we have started for instance in Bombay?—They are exactly the same as the schools in the Punjab; you merely copied the Punjab model.

700. Then why do you recommend the Punjab type as superior?—I merely call it the Punjab type because the system was started in the Punjab before it was started in the Bombay Presidency.

701. Do you recognise that the agricultural schools in the Bombay Presidency are extremely popular and they are said to be a success?—You mean the vocational schools?

702. The agricultural bias schools?—I quite agree; and that is the reason why I am recommending that a similar system of agricultural education should be introduced in other Provinces.

703. Therefore you would not be quite prepared at this stage to prepare a scheme giving prominence to the Punjab type of school?—I am afraid we do not quite understand each other. The types are not different; they are exactly the same.

704. We can therefore go on with our bias schools as we are going?—Yes.

705. Talking about implement manufacture, did certain manufacturers bring to your notice their difficulties chiefly about railway freights and classification of railway rates?—No; but I had a letter within the last two months from Kirloskar Brothers pointing out that the one great obstacle to any great extension of the trade in agricultural implements was high freights on the railways.

706. Did you take any action about it in advising Government to take up this point with the railway authorities?—I am not supposed to; I was Liaison Officer to this Commission at the time; these questions are now being brought before the Commission.

707. Do you know how many Indian factories for the manufacture of agricultural implements are in existence in India?—I could not tell you the exact number; I suppose there must be hundreds; there is in each Province a large number of small concerns manufacturing winnowers, ploughs, etc.

708. You say there are hundreds; you mean of the small type?—Yes, of a very small type.

709. I am talking of those on a fairly large scale?—There are very few, the only one I know of is Kirloskar Brothers.

710. You have in the Provinces agricultural engineers who design implements for Indian conditions?—We have.

711. Do you know whether they are trying to introduce modifications of new designs to suit Indian conditions?—Yes; they are trying to.

712. Have you got any specific types in which our agricultural engineers have improved upon the foreign implements to suit Indian conditions and if possible to cheapen them here?—Yes.

713. In which particular Province do you mean?—They have done so in the Central Provinces and in the Bombay Presidency for example.

714. In Bombay which is the particular type evolved by the agricultural engineer?—A seed-drill.

715. The seed-drill was the result of a competitive prize given by the Department, I think?—It is the agricultural engineer who is really trying to produce this new design. In the Punjab they have evolved an improved machine for boring for water; and in the United Provinces they have improved certain types of water-lifts.

716. On the whole you are satisfied with the results of the adaptation of western types of implements to Indian conditions?—The Departments of Agriculture have not had their engineers for any length of time; in the Central Provinces their engineer joined in the year 1920, for instance, so he has only been at work for 5½ years. Our agricultural engineers have not as yet had time to do very much.

717. Are these agricultural engineers men brought up in the country or are they men with foreign qualifications?—Most of them are men with foreign qualifications; in Bihar & Orissa on the other hand their engineer was trained in this country.

718. So far, therefore, nothing very outstanding in the way of the adaptation of western implements has been done; nothing very outstanding, I mean, in creating new designs and new types?—Yes; quite a lot has been done.

719. The seed-drill is the only thing you can think of in Bombay?—So far as I know.

720. Now, with reference to marketing, you have had some experience about the new cotton marketing system in Berar?—Yes, I have.

721. Will you just tell the Commission whether by this new system of marketing of cotton the producer gets the fullest value he ought to get for the quality and quantity of his cotton, without any filtering of his legitimate dues owing to middlemen or other causes?—There are certain defects even in the Berar system. Cotton, when it is brought into the market, is sold through a commission agent and when it is weighed there are complaints to the effect that the weighments are not always very accurate. There are small defects of that kind, but it is certain that in establishing such open markets Government has thereby provided a place at which cotton can be sold at the market price of the day.

722. Who fixes the market price of the day?—The buyers; they get telegrams from Bombay and then the cotton is auctioned and sold to the highest bidder: there are several buyers in each market and there is a good deal of competition.

723. You think that the cultivator is not defrauded either by the grading, or the quality that is fixed without his consent, when the consignment is brought to the market?—There is a certain amount of fraud practised even yet. When a cartload of cotton is sold, and unloaded, for example, the buyer at times finds there is a little dirty cotton in the cartload and refuses to pay the price at which he had bought it. On the other hand there is no doubt but that the cultivator gets a better price for his cotton in an established market than he can in his village.

724. So there has been some improvement?—Great improvement; so great an improvement as a matter of fact that the Indian Cotton Committee after studying the marketing system in Berar, recommended that the same system should be adopted in other Provinces.

725. *The Chairman:* Have you ever heard it suggested that the sale in the controlled market of Berar is sometimes a dummy sale that the cotton passes through the market and that the actual sale is effected outside the market afterwards?—No; I have not heard that.

726. *Mr. Kamat:* I want to ask you something about veterinary research and cattle improvement. Do you not think that the Central Veterinary Research Institute at Muktesar is too isolated for the purposes of the country?—It is isolated. If I were to select a site for a Veterinary Research Institution, I would not select a site which is so far away from a railway station. Muktesar is about 24½ miles from the railway station. On the other hand it has certain advantages. I do not think that the orthodox Hindu would like to have a research station of that kind in a centre near a big urban population.

727. Is that the only reason why it has been located there, or are there other grounds; suitability of climate and so on?—The climate is one of the considerations. The vaccines and the sera produced tend to go bad if they are kept at a temperature much above 40 or 50 degs. c.

728. Is the Director in charge of that Institute able to go round the country, and are there any means for similar research on a smaller scale in the Provinces?—There is little or no veterinary research being done in the Provinces: the Provinces have not yet provided laboratory accommodation and the staff required.

729. So you think that so far as cattle improvement or the prevention of disease is concerned, the fact that there are no facilities in the Provinces in this respect is a great handicap?—I think so, and for that reason I have recommended an All-India organisation to be called an Advisory Council, and that we should have in the Provinces research laboratories working in co-operation with Muktesar and investigating the different cattle diseases and their causes.

730. In whatever little veterinary work that is being done in the Provinces, either at the colleges or by the Indian Veterinary Superintendents, is there any co-ordination between the Muktesar Institute and the local institutions in the Provinces?—I think there is very very little research being done in the Provinces except in the Punjab. In the Punjab they are co-operating with Muktesar, but there is not much co-operation because there is no considerable amount of research work being done.

731. You are aware of the present system of cattle-breeding that is carried on in the Provinces, and you have cattle farms in different districts but no far-reaching system of supplying premium bulls to different villages. Is that right?—They have introduced the premium bull system in Bombay and in the Central Provinces already: it is very desirable that they should have the same system in other Provinces as well.

732. But even this premium bull system is so inadequate compared to the large number of villages that you would not call it a very satisfactory system, would you?—It is a very satisfactory system, in my opinion, if you can increase the number of bulls very largely, but at the present time there is a very small number of good bulls available.

733. Whatever prize cattle you show, are the bulls you exhibit confined only to a very few small centres and not even seen by the villagers?—Do you mean that we have not got a large number of cattle shows?

734. I mean cattle shows?—That is so, I believe.

735. Do you know that in ancient India there was a system of keeping a premium bull in each village which was maintained on charitable or religious grounds and which served very well for the purposes of breeding?—Do you refer to the Brahmani bull system?

736. It was a bad system in some respects, but could you adapt or modify that system if Government undertook to regulate it?—I do not think it is a good system. I studied the whole system fairly carefully last year in Bihar and Orissa when I was chairman of a Cattle Committee that went round, and I found that the objections to the Brahmani bull were that he was allowed to roam about without let or hindrance and that he did a lot of damage to the crops.

737. That is why I say is it not possible to adopt that system by bringing the work under Government control?—Another objection was that the bulls which are now dedicated by certain religious Hindus as Brahmani bulls are often of very poor quality. Instead of dedicating the best calf, they dedicate the worst. That was the complaint among the villagers.

738. Now, speaking about the welfare of the cultivators, I think you told the Chairman something about birth control?—I did not mean to lay much stress on that, but I notice that in a memorandum sent by Mr. Knight he refers to it. He is the Collector in Khandesh.

739. Was that idea due to any feeling that the rural population is increasing?—It is increasing. I believe the population of India has increased by about a hundred millions in the last fifty years.

740. Taking only the last decade, do you think that the rural population has definitely increased?—It has definitely increased within the last decade.

741. I wonder whether you have seen the memorandum issued by your department and supplied to the Commissioners about economic progress in the Bombay Presidency.* There, I think, figures are quoted showing that the

*The Economic Progress of the Rural Areas of the Bombay Presidency, 1911-22, by Dr. Mann.

population has not increased on the whole in the last decade?—I think the tendency generally is for the rural population to increase all over India.

742. In the Economic Progress Report issued by Dr. Mann for the period ending 1922, he gives a table showing the increase or decrease in the rural population district by district, and he definitely says that in East Khandesh, for instance, there is an increase by 2 per cent., in West Khandesh there is an increase by 6 per cent., but in Nasik it has gone down by 10 per cent., in Ahmednagar by 23 per cent., in Poona it has gone down by 10 per cent., either due to migration or other causes?—Taking India as a whole, I think the rural population is increasing.

743. Would you be surprised that so far as the smaller villages below a population of one thousand are concerned, the population is not increasing; it is stationary?—I can quite understand that in certain localities where the textile industry is being expanded very fast, the villages are losing a large number of their labourers.

744. What I mean is that this question requires very careful investigation and we need not assume that the population is increasing so as to disturb the welfare of the village community?—I think you must take a fairly long period. Taking a period of fifty years, you would not question my statement to the effect that the population has increased by about a hundred million in fifty years.

745. *The Chairman*.—Was there influenza during the period of ten years referred to in that book you quoted?

Mr. Kamat: These are figures for 1911-1922 during the influenza period.

746. *Sir Thomas Middleton*.—It has occurred to me that in directing a searchlight on the Indian Agricultural Department, we are in some slight danger of losing our sense of perspective, and I want to ask you this question. Are you, or are you not, aware that many of these problems which have been facing you, are problems which are common to developing Agricultural Departments?—Yes, I am aware of that.

747. If you had not been aware of it, I was going to say that in my experience such problems have been quite common in the development of Agricultural Departments in Great Britain in the last ten or fifteen years. Now, I want to ask you one or two questions on points on which you have been questioned. We all desire to secure the greatest possible amount of co-ordination between the central and provincial departments, but from my point of view I was disposed to think it was rather a healthy sign to find that the provincial departments have not been applying to you for advice so much in recent years as they did originally. Do you agree?—I entirely agree with it; some of them have developed their own research sections and do not find it necessary to come to Pusa for assistance to the same extent as they used to. It is only the departments who have not got special expert officers such as mycologists and entomologists who come to us freely for assistance. They now have their own chemists to do soil analyses; they have their own plant breeders too who are doing plant breeding, and do not in consequence find it so necessary to come to Pusa now for assistance.

748. It is a stage through which any developing department must be expected to pass?—I quite agree.

749. Now, one of your chief difficulties has been due to changes of staff, and in this connection there has been a reference to the influence of the Reforms. May not the effect of these Reforms in a sense be regarded as incidental in this way, that opportunities have been given to men to retire, good posts were available elsewhere, and it was not unnatural that the opportunity being there and the posts being offered elsewhere, a certain number of men should have retired at the time?—Yes.

750. There is no reason to suppose that this state of affairs will continue?—No, I think the men in the service at present are quite satisfied, despite the fact that they are working under a reformed Government.

751. It was a purely transitional and incidental effect of the change?—It was partly due to the fact that in the days of non-co-operation dating from 1921 there was a certain amount of racial feeling.

752. You refer, in connection with the training of men at Pusa, to the absence of instincts and traditions. Would you agree with me that in developing work of this sort instincts and traditions are not, after all, very difficult to create?—I agree with you.

753. You are of course aware that our “instincts and traditions” in Great Britain, for example, have been the product of the last 30 or 40 years. Further you may agree with me that although at the present moment Pusa may not have the instincts and traditions which you would desire, there is no reason to suppose that these cannot be acquired within a comparatively short period?—There is no reason; none whatever.

754. In listening to the account which you gave yesterday of the work at Pusa, I got the impression, I may have been mistaken, that the work at Pusa was regarded as consisting almost wholly of the production of the Pusa wheats. Now, quite recently I happened to look through one of the latest volumes of the *Agricultural Journal*, and there I found at least one paper which was of fundamental importance on another subject, and it was the work of persons working at Pusa. Do you agree with me that in addition to the production of wheats there has been quite a substantial amount of fundamental work done at Pusa?—Yes. We have done a great deal of fundamental research which does not bring in any profits, and which we probably cannot apply at the present time. It has, however, added to our knowledge of scientific agriculture, as for example, our work on soils, etc.

755. I am thinking of work on the root range of fruit trees?—Yes, that was by Mr. Howard.

756. That seemed to me a piece of work of quite fundamental importance?—It may not bring in any rupees, annas and pies immediately, but it has added to the sum total of our knowledge of plant life.

Then, to touch on this difficult question of the Indianisation of the Services: The policy which you stated seemed to me to be not solely an Indian policy but a policy which is common among all the nations whose agricultural progress I have studied. Mr. Chairman, you and I come from a country which has sometimes been accused, rightly or wrongly, of attempting to keep its posts for its natives. Just before I left home I was asked to agree to an appointment by a Scottish institution and I noticed with some interest and some degree of satisfaction that it was an Englishman who was proposed for the post. In England we have been trying for quite a number of years to train men in the country to fill the posts which require filling. Quite recently however it has been necessary for us to go to the United States of America and bring a man from that country because we could not find one suitable in England. So that, in listening to Dr. Clouston's exposition of his policy in this matter, it seemed to me that the policy advocated by him for adoption in India closely resembles the policy on which other countries are now working. At this stage I do not wish to put any further questions to Dr. Clouston, but I do wish to emphasise the need, in examining these Indian problems, of maintaining a due sense of perspective.

757. *Sir Ganga Ram*: When you are giving appointments, when you are selecting boys for the Pusa work, are you governed in any way by communal considerations, or are you only governed by merit? Supposing there are two candidates, one a Hindu and one a Mahommedan, and the Hindu is superior, but if there are already many Hindus at Pusa, would you give the appointment to the Mahommedan?—Certainly not: we would give the appointment to the best man.

758. So your selection is entirely governed by merit and not by communal considerations?—Yes.

759. Now, boys go to England for agricultural training on their own account and come back after three years, and there are the boys who are the output of the colleges here. Do you find these boys who get their training

in England in any way superior to the output of your colleges? I am not now referring to the boys who are sent by Government for some special training but to the boys who wish to see England and can afford to go there and get a training on their own account. Do you find, in your experience, that such boys are superior to the output of your colleges?—It is very difficult to answer that question; but I may say that a great many of the Indian students who have gone home for training in agriculture are students whom I would not have selected for such training. They go Home because they can afford to do so and they very often study both law and agriculture at the same time. They have not got any special bent for agriculture and, I think, that men of that type are not likely to make good when they come back to this country.

760. Have you made any research on drying vegetables? Howard did a lot in Pusa. Do you make any?—We have done nothing since the Howards left Quetta.

761. *Sir Henry Lawrence*: There was one question to which I could not quite grasp your answer. It was in regard to the selection of applicants for the post of chemist, I think. Was it a post of chemist?—No, it was for post-graduate training in chemistry at Pusa.

762. And out of 16 applicants you could find nobody qualified?—Nobody was qualified.

763. Do you mean they were not qualified by reason of the previous examination that they had passed or did you apply any particular test of your own?—It is like this. When they come to Pusa, they are supposed to start off with research. They are not really qualified to begin research unless they have passed the M. Sc. examination. In other words, the men referred to had not got the basic training necessary to qualify them for research work.

764. So that you have laid down that for this post-graduate course no boy who has only taken the B. Sc. degree is qualified. He must take the M. Sc.?—Yes, for the reason that very few of the men who have taken the B. Sc. have covered the ground that should be covered preparatory to their starting research.

765. Then, of these 16, none had taken the M. Sc.?—That was so. I did not see the students myself but the Head of the Chemical Section, who is the Joint Director at Pusa, had gone through their applications very carefully and gave it as his opinion that not one of them was qualified for post-graduate training in research.

766. Then your answer does not imply that the Universities do not teach up to the standard that you require?—Oh no, it does not imply that.

767. But at the same time, the standard of teaching at the Arts colleges is not high in science. Are there not other institutions of which the standard is sufficiently high?—In the Punjab it is fairly high: in Bombay too it is fairly high; at the Arts colleges in Bengal and Bihar and Orissa, it is not.

768. But would you accept the product of the Arts colleges of the Punjab and of Bombay?—Yes, when the student has taken his M. Sc.

769. What about the Institution of Science in Bombay? Have you had any applicants from there?—I do not think we have ever had an applicant from there up to date.

770. Is their teaching sufficiently good?—I think so.

771. *The Chairman*: Do you think that any University in India is capable of providing an education in pure science equal to that of the Universities in Great Britain?—Well, I should not like to give an opinion, for the reason that I do not know enough about the standards.

772. How would you account for the fact that there were no men who had passed their M. Sc. anxious to come forward for these appointments?—One of the reasons is that the very best science students go in for medicine because it pays them better. A post in the Medical Department is worth more to them than a post in the Department of Agriculture.

773. *Dr. Hyder:* That is to say, after they have taken the B. Sc. degree?—Yes.

774. But do you not know that in order to get into the Medical Department you must first pass the F. Sc. and go straight on to a Medical college? Otherwise, it would be a waste of four years?—What I mean is that they make up their minds from the time they have taken their First Arts to go in for medicine and very few of the really good students study up to the B. Sc. standard with the view of specialising in agriculture later. They make up their minds to go in for medicine and they take medicine.

Sir Ganga Ram: Let me tell you that in the Punjab you have got a medical group which you take up after passing the Matriculation. It is only those boys who are admitted into the Medical College.

775. *The Chairman:* Assuming that there were opportunities for the training of higher research workers in India, do you think it would be to the advantage of a man preparing himself for the higher posts to go to England or to go abroad at some stage in his learning life?—I think it would be. It would be advisable to let him take study leave, because it would widen his outlook, and bring him into touch with other great minds.

776. At what stage of a man's learning career do you suggest that he should go abroad?—I would first take him into the department and let him take study leave after four or five years. I would send home only selected men, i.e., men likely to benefit from a course of training abroad.

777. By that time he would be 22 or 23?—No, he would be 26 or 27.

778. *The Raja of Parlakimedi:* Just a little more information about sugar-cane. As India has to import a lot of sugar, is the Department paying attention to getting a type of sugarcane to produce the maximum quantity of sugar in India?—I consider that we have not done enough in the way of carrying out the recommendations of the Sugar Committee. The reason for that is that the Government of India have found it very difficult to provide the money required, and the Provinces are in the same position, I daresay. But we have within the last two years spent a good deal at Coimbatore. We have acquired a new area of 38 acres; we are now taking up the breeding of thick canes on that new area. We have appointed a second cane-breeding expert and added some more men to our subordinate staff too. We have also decided to devote more time to the improvement of cane at Pusa; there is a great deal more work being done there now than used to be.

779. What are the methods of demonstration carried on by the Department so that these improved varieties can reach the ryots?—In most Provinces we have demonstration farms where the improved variety is grown alongside the ordinary country cane; seed of the improved variety is afterwards given out to the cultivator.

780. Have you got sufficient hands to go among the ryots and teach them the benefits of growing these improved varieties?—No. The staff employed is certainly most inadequate. In some Provinces in India one Assistant is responsible for an area of nearly a million acres scattered over 300 or 400 villages. Generally speaking the staff is much too small, but in the more advanced Provinces they are adding to it every year.

781. Do you not think that to meet that difficulty and to work on practical lines, Indian labourers can be trained to go about and explain to these ryots practical methods of growing sugarcane on an economic basis also?—Yes, I think so. About 12 years ago I started a system in the Central Provinces by which we trained ploughmen to demonstrate the improvements which we had tested. These ploughmen were called *kamdars*. We employed a large number of them. We put them in charge of the demonstration work we were carrying out in the village and they with their own hands actually demonstrated to the cultivator the new processes that were involved in carrying out the improvement.

782. It was effective, was it not?—Very effective.

783. Has it been carried out in other Provinces also?—It has been taken up since in certain Provinces. They probably give them different names. We called them *Kamdars* and *Jemadars*. In other Provinces they give other names now.

784. It is not very costly, is it?—The men were started on Rs. 12 a month and they rose to Rs. 40. Rs. 40 was the maximum pay.

785. They are called *Maistris* in our Province.—Probably, yes.

786. What is the manure that you suggest for sugarcane to increase the sucrose?—I do not think that the manure has much effect on the sucrose percentage, but the manures recommended in Madras are oil-cakes and fish manure. In Bombay the Department recommends the use of oil-cakes and sulphate of ammonia mainly. In the Central Provinces, too, oil-cakes are being used; the manures in favour vary from Province to Province.

787. Has gingelley cake (*til* cake) been experimented upon?—Is it better than ground-nut cake?—It is much cheaper and for that reason it is a more economical cake to apply.

788. Which is cheaper?—The *til* cake.

789. I do not think it is cheaper, at least in our Presidency?—We used to buy *til* cake at Rs. 40 a ton in the Central Provinces before the war. It is now about Rs. 75 or Rs. 80 per ton, I believe.

790. Is ground-nut taking its place?—In the parts of India which I know well, ground-nut is an expensive cake; it is used more as a cattle food than as a manure. It is considered too expensive to use as a manure.

791. Actual experiments have not been conducted to find out which is the better of the two, ground-nut or *til* cake?—Ordinarily one does not experiment with edible cakes such as linseed and ground-nut cake as manures for the reason which I have given, namely, that they are more valuable as cattle foods.

792. Another point about buffaloes, which are so helpful for paddy cultivation in Southern India. Is the Department paying enough attention to improvement of these or to maintaining good varieties of buffalo in the country?—I think that the Department is not giving enough attention to buffalo breeding; but the same statement applies to cattle-breeding generally. They have a buffalo farm in Madras and they have buffaloes, too, on some of the cattle-breeding farms in other Provinces. The buffalo breed which they are trying to improve is the Murra-breed, which gives a big yield of milk. It is being improved with a view to increasing its milk supply.

793. It is not carried on on the lines of combining both draught and milk supply?—The Murra buffalo is as good a draught buffalo as the ordinary non-milch buffalo and when you improve it for milk you do not reduce its value as a draught animal.

794. Is it attracting the attention of the Department that the Kolahandi breed is one of the best breeds for draught buffalo?—That may be so in Madras, but I do not know whether they have the same breed in other Provinces.

795. It is considered a happy mean to cross breed between the Delhi and the Kolahandi breeds. It will then produce both draught and milch buffaloes?—The Delhi is another name for the Murra breed; it is being used in some Provinces for cross-breeding.

796. *Sir James MacKenna*: With reference to the location of the Imperial Bacteriological Laboratory at Muktesar, primarily as a manufacturing institute for vaccines and sera, one of the reasons for selecting that site is that the hill bull, which is the best material for the manufacture of the vaccines and sera, is available there in large quantity and at moderate prices?—Yes, that is so. But we might have had the station nearer Kathgodam, i.e., nearer the Railway.

797. Pusa has come in for a good deal of criticism, and I am putting you a sort of leading question. Taking your experience into account would you say that the work of the late Mr. Maxwell-Lefroy on Indian insect pests and

the work that is being done now by Mr. Fletcher in the same field, Dr. Butler's work on Mycology, Hutchinson's work on diseases of the silk worms, Harrison's work on soils combined with Howard's work on various crops, *plus* Henderson's work on cattle-breeding, is enough to justify the reputation of Pusa as a Research Institute during the short period it has existed?—Most certainly. I believe the research work done at Pusa is equal to that done in any part of the world. That is my opinion.

798. *Professor Gangulee*: Following up the question which you have just answered, I should like to ask you whether these researches of Maxwell-Lefroy, Fletcher, Butler, Howard, Hutchinson and Harrison are being followed up now?—Yes.

799. For instance, Butler's fundamental work on Mycology: in what direction has that work been followed up?—Dr. McRae has, within the last year, given a great deal of attention to mosaic disease in sugar-cane.

800. I am referring to fundamental work, work such as that done by Dr. Butler?—It is very fundamental for the reason that this mosaic disease was only discovered in India about two years ago. It was supposed that Indian canes did not suffer from this disease. Now we find that it is fairly wide-spread, and Dr. McRae can claim credit for having discovered it. At the present time he is studying a fungus disease of the betel vine. That is fundamental enough. It had never been previously studied in India.

801. Dr. McRae has got two fundamental diseases under consideration at the present time, the mosaic disease in sugarcane and this other disease?—I only mentioned two. He has quite a number in addition to that.

802. Do you think that it would lead to efficiency for a man to embark on so many lines of research work?—We have asked for a second mycologist. I provided for the post in the budget last year but the money was not voted. I have again made provision for the post in the budget for this year.

803. Do you not consider that these bulletins that I had occasion to read and that are published by the Pusa Institutes are more or less of a descriptive nature? For instance, you have just referred to the mosaic disease in sugar-cane. I may be quite wrong, but so far as I can see, the published bulletins are more or less of a descriptive nature. When I refer to fundamental research, I mean research into the question such as, why a particular variety of sugar-cane is more immune from mosaic disease than another? There is the problem of immunity and the problem of susceptibility. These are questions of a fundamental nature. I should like to know whether any researches are being conducted in these directions?—Yes, but I think you have read only the bulletins. The bulletins are written in non-technical language for men who are not capable of understanding scientific reasoning; the relation between cause and effect is discussed in a separate series of publications known as memoirs.

804. In answer to Sir Thomas Middleton you referred to some fundamental researches on soils. Would you give us some indication of the nature of the work?—You mean as done now by the physical chemist or by the bacteriologist?

805. In answer to Sir Thomas Middleton you said that you were carrying on some researches on soils and I should like to get an idea of the nature of the work?—There is a lot of work being done on the movement of water in the soil, and the movement of the moisture from the sub-soil to the surface. Quite a lot of work has been done on these lines within the last two or three years.

806. In interpreting the result do you attempt to correlate the various factors that may be at work, such as season, rainfall, and other factors that may influence crop growth?—Yes. You must take for granted that the men we have at Pusa are very highly skilled research workers. They are first class scientists and know exactly how to tackle their scientific problems.

807. The reason why I am asking you this question is this. You may carry on an experiment for a couple of years and then jump to certain conclusions, whereas at Rothamsted experiments have been carried on for 80 years and

are still being carried on, and they have not yet come to any definite conclusions. When you are interpreting the results of experiments you have to correlate the various factors and find out by statistical examination the accuracy of the results before you arrive at definite conclusions. The importance of that work is so much that the Rothamsted station has felt the necessity of appointing a statistician solely for the purpose of weighing the results of these experiments. Do you have anything of that sort in Pusa?—We have appointed an agronomist who will in course of time be our statistician. We got him only within the last 7 or 8 months. Dr. Harrison, who visited the Rothamsted station last year, when he was on leave, has given it as his opinion that the work done at Pusa on soils is as good as that done at Rothamsted. When you have him before you, you can find out exactly what he thinks of the work at Rothamsted.

808. You naturally put a great deal of emphasis on better seeds?—Yes.

809. Do you have testing experiments such as are done, for instance, in the National Institute of Agriculture in Cambridge?—No, but I hope the time will come when we will have a man for that purpose. We have done nothing in the matter of seed testing so far.

810. You have said a great deal about co-ordination. Are you aware of the steps taken at the Rothamsted experimental station towards co-ordinating all researches?—I know what has been done by the Ministry of Agriculture at home.

811. I am referring, for instance, to the series of experiments conducted in regard to barley in different parts of Great Britain?—I know they are having tests carried out by farmers scattered all over the place.

812. When they carry on experiments on barley, they try even to co-operate with the malting and brewers' associations so that they can find out the percentage of malt in relation to manure and so on?—Yes.

813. Do you not think that that sort of co-ordination is possible at the central station at Pusa?—Barley and malt are not very important in India. There is co-ordination of that kind: each head of a section sees to that.

814. There is nothing to prevent you carrying on that sort of co-ordination, from instituting that method of carrying on research all over the country, testing your results under various conditions and so on?—You mean, to get it done through the Departments of Agriculture in the Provinces?

815. Yes?—That is being done to a certain extent at present, but we have not gone far enough.

816. Co-ordination of that sort does exist?—Yes, to a certain extent.

817. *Mr. Calvert*: So far as the botanical work that has been done is concerned, it has been directed to crops of direct economic importance?—Yes.

818. But it seems to me that there is further scope for botanical work on such subjects as grasses or shrubs for stopping soil erosion or for training rivers. At present you have not done that?—We have not done it at present for the reason that we have much more important work still remaining to be tackled, work which we consider more urgent.

819. As far as the study of the question of stopping soil erosion by trees is concerned, it is a matter of forest economy; but as to using shrubs and grasses to prevent soil erosion or for river training, that is nobody's business?—It has not been done at Pusa. A certain amount has been done in the United Provinces by the Forest Department.

820. Not in grasses and shrubs?—Not as far as I know. We certainly do nothing at Pusa. We test fodder grasses of direct economic importance at Pusa.

821. I am talking about botanical work of indirect importance. There is scope for further botanical work which has not yet been covered?—There is any amount of scope, I should say.

822. There is scope for further botanical staff for such work as I have suggested, which does not come under your sphere?—Yes. My Advisory Council will when it comes into existence go into these problems.

823. These are hardly agricultural matters, are they?—We would have to have experienced members of the Forest Department on our Advisory Council.

824. *Mr. Kamat:* One little point was left over in my questions to you just now about subsidiary industries. Do you know whether any Provincial Government has attempted to find out the actual economic value of such industries as are usually mentioned, such as bee-keeping, poultry-keeping, or sericulture in the list of subsidiary industries and to demonstrate that particular industries are suitable for adoption by the cultivators in this country?—They have done a good deal of work in sericulture in Bengal; they have done very little work I think in poultry-breeding in any part of India, except in the United Provinces.

825. And it has been definitely proved that it would be an economic asset to the ordinary cultivator?—I think there are reasons that led us to believe that these industries could be introduced with advantage to the cultivator.

826. In order to introduce them and to convince the cultivator, has any attempt been made to your knowledge in the Provinces to establish any such model industry, so that people could go and see how bee-keeping or sericulture or poultry-keeping helps people?—I think so. In Bihar and Orissa the Department of Industries has done a lot to encourage sericulture and the manufacture of silks as a cottage industry.

827. In your opinion Provincial Governments are establishing some such model subsidiary industries in certain suitable places for the benefit of cultivators?—I think so.

828. Have you advised Provincial Governments to carry on such model industries in certain places, for instance in Madras and Bombay, and has it been taken up?—You must remember that the Agricultural Adviser is not supposed to interfere with or to give advice to the Provinces unless he is asked to. If I were to advise the Local Governments, they would probably resent my offering advice.

829. It would be desirable to advise them?—Yes, it would.

(The witness withdrew.)

**Mr. J. A. RICHEY, M.A., C.I.E., Educational Commissioner with
the Government of India.**

Memorandum on Agricultural Education in India.

The following statement shows the number of institutions in India devoted to the teaching of agriculture together with attendance and cost during 1924-1925.

Agricultural Education, 1924-25.

Government Institutions.	Average attendance.	Annual cost.
<i>(a) Agricultural Colleges—</i>		
		Rs.
1. Poona	179	1,37,659
2. Coimbatore	46	86,354
3. Nagpur	82	54,840
4. Cawnpore	88	74,247
5. Lyallpur	129	1,07,480
6. Mandalay	(Not available.)	
TOTAL	524	4,60,580

(b) Agricultural Middle Schools—

Province.	No. of schools.		
Madras	2	50	15,885
Bombay	6	156	53,289
Bengal	1	16	6,573
United Provinces	1	35	14,286
Central Provinces	2	(Not available.)	
TOTAL	257		90,033
GRAND TOTAL	781		5,50,613

N.B.—Figures have been taken from the General Educational Tables for 1924-25.

In this table are not included the Agricultural Research Institute at Pusa and the Imperial Institute of Animal Husbandry and Dairying at Bangalore. The former of these is, as its name implies, primarily a research institute but it has recently opened classes for post-graduate teaching. There are five research students at Pusa and five at Bangalore; there are also thirteen students of the Agricultural Institution taking a two years' course for a diploma in dairying. At both institutions also short special courses are held.

(a) Agricultural Colleges.—The need for agricultural colleges to train the future personnel of the Agricultural Department as well as to provide education in scientific agriculture for those engaged or intending to be engaged in farming was recognised as soon as the Agricultural Department was re-constituted in 1905. Colleges were founded at Poona in the Bombay Presi-

dency, Coimbatore in Madras, Sabour in Bengal, Lyallpur in the Punjab, and Nagpur in the Central Provinces. There was at first some confusion in the organisation of these institutions owing to the dual nature of the functions they were intended to perform. In 1913 each Province was given a free hand to work out its own scheme with reference to the stage of general education and agricultural research that had been reached. Actually the lines on which the colleges have been developed have been influenced by developments in general education. The widening of the sphere of University work in India so as to include professional and technical education, by the affiliation for example of medical and engineering colleges, has been followed by the gradual incorporation of the agricultural colleges in the Provincial Universities. This development has been due not so much to the desire of the Universities to teach an all round curriculum as to the desire of the college students to obtain degrees. Peculiar importance is attached in India to the possession of a degree, which is not only a passport to higher appointments in public and private service but also carries with it a certain social *cachet*. The affiliation of the agricultural colleges to the universities, thereby qualifying successful students for degrees, has had a marked effect in increasing the number of applications for admission. The Sabour College which did not take this step in time proved a failure and had to be closed in 1924.

At present, the Poona, Coimbatore, Lyallpur and Nagpur colleges are attached to the Provincial Universities. The Lyallpur College has also a post-graduate course teaching up to M.Sc. in Agriculture. Two more recent institutions—the Cawnpore Agricultural College and the Mandalay College opened in July 1924—have not yet qualified for affiliation. In the former case, however, the examination at the conclusion of the first two years has now been recognised by the Intermediate Education Board of the United Provinces and the conversion of its final two-year diploma course into a degree course is only a question of time. At Mandalay it has not yet been possible to raise sufficiently the standard of admission to qualify the students for recognition as University students. The Universities of Madras, Punjab and Nagpur have faculties of Agriculture. In Bombay Agriculture is a branch of the Science Faculty. The full college courses are of four years except at Poona where, as in the Engineering College, the course is one of three years only, and at Mandalay, which has also as yet only a three years' course.

In addition to the full degree course the college also provide short courses of one (in the case of Poona) or two years (elsewhere), distinct in character leading upto a diploma or certificate in agriculture. These courses are intended primarily for practical agriculturists but they also serve to train men for employment in the subordinate ranks of the agricultural services. These courses have met with very varied success. The certificate course at Madras has failed completely with the cessation of recruitment from it to the agricultural service. It is proposed now to substitute a special intermediate course leading up to a University Intermediate examination.

Agricultural colleges perform three functions—

- (i) They are the Provincial centres for scientific research in agriculture.
- (ii) They train officers for Government service.
- (iii) They give instruction in modern agricultural methods to those who either farm for themselves or act as agents to land-holders.

(i) As centres for agricultural research the colleges with their well-found laboratories and staffs of specialists fulfil an indispensable function in the agricultural development of the Provinces.

(ii) The colleges also provide the main source of recruitment for the ordinary ranks of the agricultural department. In addition, at some of the colleges, e.g., Lyallpur, courses are held for revenue officers as also for the training of teachers for agricultural work in schools. It is open to question whether their utility as a training ground for Government servants has been fully recognised. A graduate of an agricultural college who has subsequently

been through a course of education at a training college should make quite as efficient an inspecting officer for rural schools as the graduate of an arts college. He should in fact be in many ways more suitable for employment as an assistant district or deputy inspector in rural areas, in that he would be in closer touch with the lives led by the parents of the school boys. The standard reached by agricultural college graduates in English, mathematics, etc., is as high as that demanded of graduates of arts colleges. In making appointments to certain services employed on rural areas, e.g., irrigation, co-operation and education, a certain preference might be given to graduates of agricultural colleges.

(iii) A few practical farmers take the diploma and certificate courses. Of the students taking the degree courses the very great majority have in the past aimed at public employment. They have in fact been would-be Government servants and not would-be agriculturists. Any diminution in recruitment to the agricultural services in a Province is at once reflected in a decline in the number of candidates for admission to the agricultural colleges. The question of increasing the number of practical farmers under training is primarily economic and not educational. So long as the graduate of the agricultural college has not, and through lack of capital he very rarely has, any opportunity for turning his scientific knowledge to account it is useless to expect any large increase in the number of such students. The Punjab Government have under consideration a system of leasing farms on very favourable terms with Government assistance to selected students of the Lyallpur Agricultural College. The experiment appears promising. It must be remembered that men of education in India do not as a rule make their homes in the country owing to the lack of amenities; the products of the medical colleges all congregate in the towns. This leads to considerations which are outside the scope of this note.

(b) *Agricultural Middle Schools.*—The first agricultural middle school for the special training of the sons of farmers was opened in the Bombay Presidency in 1910. At a conference on agricultural education held in Simla in 1916 under the presidency of Sir Claude Hill it was resolved that similar schools should be started in other Provinces, the aim being to have at least one such school in every district. This proposal was more fully and carefully considered at a meeting of the Board of Agriculture held in December 1917 at Pusa. The Board recommended that, until there was an effective demand for such schools arising from the appreciation by farmers of the advantages of improved methods of agriculture, only a few agricultural middle schools should be started in each Province as an experimental measure. This policy which had already been adopted by Bombay was followed in Madras, Bengal and the Central Provinces. There are now six agricultural middle schools in Bombay with an attendance of 156 students. Of two such schools started in Bengal one has been closed and the other is being altered in character. Exactly the same is the history of the two schools in the Central Provinces as also of the two schools in Madras. The Government of the United Provinces maintains one such school at Bulandshahr.

Agricultural middle schools are strictly technical or craft schools providing a course in agriculture of a practical character for boys who have received a general education up to about the age of thirteen. The object is to send the pupils back to their own land to cultivate it better. Bombay alone maintains that these schools have proved a success. But in Bombay the students are not only provided with free lodging and tuition but receive stipends. Even these inducements have proved insufficient in Bengal where the students are provided with free lodging and tuition and Rs. 10 per mensem towards their board. In Madras the students are required to pay fees of Rs. 15 per term for which they are lodged, fed and taught for three months, the fee providing only one-third of the cost of maintenance. If with all these inducements the schools have been unable to attract students, it is obvious that so far from their meeting a felt want they are actually unpopular. Moreover the schools have failed in the particular object for which they were provided. The two

schools in Madras have cost during the three years they have been open, Rs. 98,000 and of the students admitted only 38 have at any time completed the course. Of these only ten have returned to the land. Bengal reports that there were at first thousands of applicants for admission who expected to obtain Government employment after their two years at the school. Since this hope has been disappointed the number of applicants last year declined to 22. No figures are available as to the occupations followed by the Bombay ex-students but each boy at an agricultural middle school there costs Government Rs. 200 per annum.

It is clear that the caution displayed by the Board of Agriculture in 1917 was amply justified. It is not until the farmer is convinced that there is any economic benefit to be derived from sending his boy to an agricultural middle school that the demand for such schools will arise.

The failure of these schools is not a cause for surprise. The ordinary agriculturist in India either does not send his boy to school at all or sends him for a few years only while he is too young to be of use to his parents, or sends him in the hope that he may find some other opening than agriculture. The intelligent boy who passes the primary standard does not wish to enter the blind alley of the agricultural middle school. Even if he has a liking for agriculture, his natural ambition would be to matriculate and enter an agricultural college. But as a matter of fact the ordinary Indian boy is very reluctant to make up his mind as to the choice of a career until the choice is forced upon him. He goes on passing through different school stages, studying subjects which may or may not have any relation to his future education or occupation, until failure at some examination drives him out of the world of school and college to earn his living. If his failure occurs at an early stage he may be obliged to return to his hereditary occupation, if an agriculturist by birth to agriculture, but "agriculture without capital, agriculture as he has seen it carried on by his father, offers few attractions to an intelligent school boy".

There does not appear to be any future for the agricultural middle school until the standard of agriculture amongst the parents has been so raised by demonstration and the work of the agricultural department that the value of agricultural education is recognised.

(c) *Agriculture as a subject in the general curriculum.*—It is now generally accepted that agriculture, as apart from simple nature lessons, is not a subject which can be taught in a primary school and no attempt to do so is authorised by Education Departments. Agriculture is recognised as an optional subject for the Matriculation or School Leaving Certificate examination of the Universities. It is taught in a few places, e.g., at the Durgapur High School, Chittagong, and the Khalsa High School, Amritsar, on practical lines. Elsewhere Matriculation agriculture is little more than a text-book subject. It is taken by boys in preference to other options only if for any reason it is considered an easier subject in which to obtain a pass. A boy successful in this among other subjects at the Matriculation examination will proceed to college with a view to study for law or any other profession.

The Punjab did not follow the lead of other Provinces in starting agricultural middle schools. It recognised that no student of ability would turn aside from the ordinary educational course to enter such schools. On the other hand it recognised that there were a very large number of boys in rural districts who though ambitious of proceeding to the high school or college stage would be prevented by lack of ability or financial circumstances from proceeding so far. It was decided to introduce the teaching of practical agriculture in the vernacular middle schools of the countryside, in such a way as not to debar the students taking agriculture from proceeding to a higher stage of education if they were able to do so. The scheme adopted was shortly as follows:—

- (a) Selected trained teachers who are agriculturists by birth are sent to the Lyallpur Agricultural College for a one year's course in agriculture. At the conclusion of this course they are attached

to vernacular middle schools to give instruction in agriculture, receiving an allowance of Rs. 10 per mensem as special pay for this work.

- (b) Farms of three acres are attached to the schools at which agriculture is taught. These farms are purchased by Government or by means of Government grants and are equipped with store house, two pairs of bullocks, agricultural implements, etc., in order that the work may be of a thoroughly practical nature.
- (c) Every boy in the middle department passes through a four years' course in agriculture. Four periods a week are assigned to agriculture during the first two years of the course and six periods a week during the last two years. Extra work on the farm is done out of school hours.
- (d) Agriculture is included in the ordinary subjects of the middle school course, after passing which a boy is eligible for admission to a high school and so through Matriculation to the University.
- (e) The initial cost is estimated at Rs. 3,000 for land, buildings, water supply, bullocks and implements. The recurring cost is only the pay of the teacher and the loss, if any, on the working of the farm.

There are now 27 school farms in working and the scheme has generally met with success, so much so indeed that it has been recommended by the Board of Agriculture for adoption in other Provinces. Bombay and the United Provinces have already started working on the same lines. Bengal sent a committee to the Punjab last year to report on the scheme; the report was favourable and would have led to practical results this year had it not been for political changes. Unfortunately the Punjab for financial reasons has recently modified the scheme by substituting half-acre gardens for the three-acre farms. This modification cuts at the whole root of the scheme. It was introduced from motives of economy, though as a matter of fact half the school farms pay their way and a few even make a profit.

The objects of the original scheme were—

(a) to influence as many boys as possible without diverting them from the path to higher education.

(b) to keep alive in the sons of agriculturists their interest in the land so that if they were obliged to return to it instead of proceeding to a higher education they would return even better equipped to make successful farmers. Although improved methods of agriculture are of course introduced in the school farms these institutions are not intended to turn out skilled farmers, as are the agricultural middle schools. Actually it is very rare that the product of any technical school can compete at once successfully in the open market, because the commercial element is lacking in school work. This fact is commonly overlooked by the advocates of technical education who speak and write as if the product of the technical school should at once obtain a livelihood as a highly trained craftsman. Attempts to introduce the commercial element by making the school farms pay, though it is a matter of local pride, are educationally unsound. The student who makes no mistakes learns nothing.

The Punjab Government, at the same time, proposed to establish a number of agricultural centres of five-acre farms near towns which could be attended by the boys of local high schools. For financial reasons, however, this scheme was never carried out.

The success which has attended the Punjab scheme appears to justify its adoption on a much wider scale than any contemplated hitherto. It is only by some such alteration in the character of our rural schools that they can be prevented from draining the countryside of its brighter students and increasing indefinitely the ranks of the educated unemployed. Rural schools should aim at sending the rural boy back to the land equipped to be a better farmer; their whole orientation is at present wrong.*

*See question 895,

Oral Evidence.

830. *The Chairman* : Mr. Richey, you are Educational Commissioner with the Government of India?—Yes.

831. And you have been good enough to lay before the Commission a memorandum which my colleagues and I were greatly interested in reading and for which we are much obliged to you. May I ask you whether you care to make a statement in amplification of this memorandum that you have put in?—I prefer to answer any questions put to me.

832. Following the memorandum I should like to ask you whether it is your view that the training at agricultural colleges of men for Government positions and at the same time the training of young men or boys whose ambition and intention is to return to the farm is a sound one. You say at page 115 of the memorandum before the Commission :—“ There was at first some confusion in the organisation of these institutions owing to the dual nature of the functions they were intended to perform ”?—Yes.

833. Do you think it is a sound principle to train boys or young men who are going to be officials alongside of boys who it is hoped may return to the farm?—I think the number of boys who go through the colleges with the intention of returning to the farm will always be very small. I imagine if there are developments in agriculture, as there must be as a result of this Commission's labours, the demand for officials will probably absorb the output of the colleges in the near future. Besides, the experience of other countries is that a very small percentage of graduates of agricultural colleges actually go on the land. I took the trouble to look up some statistics even from America, where they have 52 agricultural colleges and I understand that nearly all the graduates are employed in educational work or as demonstrators in the Agricultural Department. I find the same thing in other countries. For instance, in Sweden, where they have only two colleges, they do not even attempt to send their students back to the land. There may be a certain number employed in responsible positions. But I do not think that is the primary function of an agricultural college. It is for research and for the provision of experts.

834. You are familiar with the working of the agricultural colleges?—I have seen them all in India. I have seen one or two of them more than once. I am not an agricultural expert; I have seen them from the point of view of education. When I say I have seen all, I mean I have seen four of them.

835. Do you think yourself that there is sufficient touch between the Departments of Agriculture and Education?—My own experience is that the co-operation as far as the colleges go has been fairly close, and certainly as regards the relation between the two Departments, they have never been anything but satisfactory. I have made a suggestion here, which I would like to amplify, namely, that the Educational Department should draw more on the colleges for its inspecting and supervising staff. It has not ever been, as far as I know, suggested, even, by any Province that they should earmark a certain number of the vacancies in their training colleges for graduates of agricultural colleges. I should like to see that done.

836. Agricultural colleges are on the budgets of the Agricultural Departments in every case, are they not?—Yes.

837. I wonder whether you would clear up a little difficulty in my own mind. Would you tell me what in your view are the outstanding differences between the system which you describe on page 116 in the fourth paragraph as being one which Bombay alone maintains as having been a success, and the system in the Punjab which you advocate?—One is a purely vocational system, an attempt at vocational training, and the other is a pre-vocational system. That is to say, one definitely aims at taking the agricultural boy

and training him to be a better farmer. The other aims merely at fitting him to be a better farmer, keeping his interest in the land and seeing that he does not during his course of schooling lose touch with the land or get soft-handed. At the same time, by giving him general culture as well, fitting him to become a better farmer in the end.

838. How about the position of a boy at the Bombay vocational school who halfway through the period of his attendance there changes his mind and thinks he would rather not go in for agriculture at all but go in for something else?—Then he has to start again where he left off. Supposing he had passed the primary course before he entered, he would have to go on from the class where he left off. As far as I know, there is no provision at all for taking into account the time he spent at the agricultural middle school towards his general education.

839. How about the position of the same boy who changed his mind in the same way half way through his school time under the Punjab system?—There agriculture is merely a subject in the general school curriculum. He need not leave that school at all; he could still go on. I mean to say, the course leads straight on. At the end of his middle school course, he is free to enter the high school classes.

840. Can he take English?—Well, that is at present a difficulty. Some of the schools teach English; others do not. Some of the vernacular middle schools who teach agriculture also teach English. The difficulty is to fit all the subjects in the curriculum.

841. Do you think that is a good plan?—I think it is bound to come into force everywhere because the tendency is for English to be introduced into secondary classes in all rural schools. I know that Bengal, who recently sent a deputation to inspect the Punjab plan, in their recommendations definitely proposed to introduce it in middle English schools. They have got few vernacular schools. The deputation proposed that they should introduce the same system only in their Anglo-Vernacular middle schools.

842. Could you give the Commission the figures of expenditure per boy under both systems?—I am sorry to say I cannot. The only tables I have brought here are All-India tables.

843. Perhaps you could let us have that?—Certainly.

844. Then on page 117, paragraph (c), 'Agriculture as a subject in the general curriculum,' you say, "It is now generally accepted that agriculture, as apart from simple nature lessons, is not a subject which can be taught in a primary school and no attempt to do so is authorised by Education Departments." Is that view generally accepted in India to-day?—I think so. I am not quite sure whether the public generally does. One reads all sorts of articles by people who are not very expert, but I think this view is generally accepted in India to-day. Certainly it is generally accepted elsewhere.

845. Even simple nature lessons are not easy things to give?—I quite agree with you there and that is our difficulty at the present moment. Even where nature study is a prescribed subject, the teachers are very weak, and apt to teach it from the book.

846. Do you think the spread of literacy is of great importance to the future of Indian agriculture?—I think it is of enormous importance not only from the point of view of agricultural education but also from the economic point of view. This is really not my subject at all, but I have no doubt that education brings new wants and natural incentives to greater or better work.

847. New wants and new efforts?—Yes, that is it.

848. And also, of course, on the technical side it is useful to be able to get information in print, is it not?—Yes; and also from the point of safeguarding the rights of the agriculturists if they can read and write.

849. He can look after his own interests in the market?—Yes.

850. Whether he is buying or whether he is selling?—Yes.

851. What are the main obstacles to a substantial spread of literacy in rural areas in India?—I should say, first of all, that the agriculturists have yet to be convinced of the pecuniary value of education. That is to say, not only in this country, but everywhere I think, the immediate value of reading, writing and arithmetic to the agriculturist is not so apparent as it is in practically every other occupation. It means giving up certain amount of his time and it means also a certain amount of expenditure. However cheap the education may be, it costs him something. We have no free books here and in many cases we even have fees, so that it always costs something, and is there sufficient return if the boy simply returns after his primary school to do exactly the same work as his father did before him? The parent has yet, I think, to be convinced of the value of education.

852. So you think that the disinclination of the cultivator in rural areas in India to send his children to school is the principal obstacle to a substantial increase in literacy?—I feel sure of it. Of course, they do send a certain number of their children to the school. Another factor, which is perhaps a subsidiary one, is that the schools themselves in rural areas are not efficient and consequently there is a great deal of waste of time. When those two causes are combined, the ordinary parent does not see that he is getting much value for what little money he does spend on education.

853. Could you hazard an estimate, the roughest estimate, of the proportion of parents who are cultivators in India who have the opportunity of sending their children to school if they so will?—I am afraid I could not give you even an idea.

854. *Mr. Calvert*: Would you say an opportunity within a 3 miles area?—Yes. Speaking of the Provinces I know I should say that such parents are about 75 per cent., but it is very difficult to say. There are hilly tracts where I know it is very little. It may be 60 per cent. On the other hand, in Bengal the villages are very close to each other and the population is very dense. There are 35,000 primary schools besides others. I should say that the opportunity is open to certainly more than 75 per cent of the cultivators.

855. *The Chairman*: I am not familiar with Indian conditions. What is a reasonable radius?—We count on two-mile as a rule, if it is without natural obstruction, 2 miles by the normal road.

856. So much about the disinclination of the parents to send their children to the school. What is the next most important factor?—I am afraid the inefficiency of the schools. In India, I suppose more than anywhere else, we have the single teacher school, where the teacher has to take at least four classes at once. Suppose he has four classes to teach, then it means that out of 4 hours teaching he can devote only one hour to one class and the result is that the progress made is very slow and the amount of wastage is enormous. A very large number of people do send their children to school just for a year or two and then the children drop off. They very often do not get very much beyond the alphabet.

857. Am I right in thinking that in primary schools three to four years is the average attendance per child?—Yes, just under four years.

858. And four out of five of such children remain in the lowest class?—Taking boys only, out of 8½ million boys in school including college and post-graduate students, 4 million are in the first primary class. That is to say, half are.

859. And a very considerable proportion of children who go to school and who reach the beginnings of literacy relapse into illiteracy, do they not?—An enormous number.

860. Do you think that is a criticism of the school?—Partly a criticism of the school and partly of their surroundings. You should remember that there is nothing in an ordinary Indian village for a boy to see in the way of reading. There are no posters, no advertisements, nothing of the kind at all.

There is no opportunity for him to read anything. Sometimes, of course, he sees *patwari* papers, but otherwise he sees nothing to read.

861. But if his mother could read, it would probably make a difference?—Yes.

862. Probably all the difference?—Yes, he would read in his own home.

863. How about the teaching of female children at primary schools?—You see they marry so young. Even in villages where the *purdah* system is not so important, the children marry very young and there is no tradition really for teaching the females. As the United Provinces Government said you can multiply girls' schools indefinitely and get millions of girls in them, but they would only come up to the age of 5 or 6 or 8 at the most. The teaching too is very inefficient because the teacher is a *purdah* woman. To get women teachers is extraordinarily difficult and the progress made in the girl schools is accordingly very slow.

864. How long have you known India? How long have you yourself been here in India?—I have been 18 years in India.

865. Have you noticed any change in the direction of the education of the women of the rural classes?—Not in the rural classes. I cannot say there has been very much movement there though in the urban classes there is distinctly.

866. You have no doubt heard that certain well-informed persons are in favour of putting what I may call a certain agricultural flavour into primary education. Is there time or opportunity to do that, do you think?—We shall have to start with our normal schools I think and we shall also have to limit it to the better class schools. I cannot see much hope in the ordinary aided schools. Certain Provinces of India depend almost entirely on aided schools, that is to say, private schools started by people for their own gain. We just aid them. Those teachers are very largely untrained and in the case of those who are trained their training consists of little more than adding to their general education. I do not think we can do much with these schools; but you could with the better class schools, properly housed and properly managed schools. With what we would call board schools something could be done if you start with the teacher.

867. Are financial conditions another bar to the extension of the educational system?—They are most decidedly. You have constant competition, as a matter of fact, between the demands of secondary education, higher education and primary education. But the primary school itself is a very cheap thing. Even the most expensive primary schools, to start with, at the beginning, does not run to more than Rs. 400 or Rs. 500 a year. In many Provinces it runs to Rs. 80 or Rs. 100 a year. It is about the cost of educating a single boy in a high school.

868. Have you ever heard it said that the educational system of India is top-heavy?—It is constantly said.

869. What view do you take on that point?—Well, it is partly historical. Naturally we have to provide education and must provide education under a voluntary system first for those who ask for it, and if the people in the towns want to get further education in colleges it is our business to see that it is not too bad. That is the difficulty.

870. Is the suggestion at the back of your mind that persons who make the criticism we have been talking about feel that if you were to cut something off the top you could add it to the lower grades?—I suppose that is the suggestion.

871. I do not ask you to agree with that suggestion of cutting at the top, but suppose you had the extra amount of financial resources, the maximum amount of financial resources which you could hope to get by any cut at the top at your disposal, do you think you could substantially increase primary education and literary in rural areas?—I think we could do a good deal more with more money; I feel sure we could. I do not mean in every Province but

in certain Provinces. In Bengal, for example, they are at present proposing a cess for that very purpose.

872. Of course if there is to be progress, opportunities for education will have to be offered a little before they are asked for in rural districts?—Certainly. It has to be done by propaganda, and as a matter of fact there is a certain amount of almost fashion in education. If a school is started in a certain area a crop of enquiries very often comes for new schools. It is quite common, at least not uncommon, for a district officer to say there is no demand for schools, but after a school is opened other demands do come in from the neighbourhood.

873. Now in the rural areas in which there has been some concentration of educational effort, do you see any dynamic tendency beginning to show, do you notice an important proportion of the rural population calling for education and for better education?—I think it is very marked indeed where any intensive propaganda has taken place, where for example compulsory education has been introduced in any rural area, as it has been in a few places, or even where it has not but where you have worked on a programme of opening so many schools a year. There is no doubt whatever that the supply creates the demand.

874. Is there anything to show that these areas where particular efforts have been made are areas different from many other districts in India? Do you not think if the same efforts were applied to many other districts where no effort is being applied at present the same result might be expected to ensue?—I feel sure of it. I cannot vouch for every area but there are many areas of which that is true.

875. So that to a very important extent the spread of literacy in India is being limited to-day by financial consideration, by a lack of financial resources?—That is quite true.

876. Now about adult education, is that going ahead?—There is very little movement as yet, I am sorry to say. There again it responds at once. If schools are opened they are well attended, in certain areas at any rate, but the number of institutions is very small. There are 2,800 in India altogether, of which 1,500 are in the Punjab and 1,000 in Bengal. I beg your pardon; those are last year's figures. This year there are 3,984 of which 2,300 are in the Punjab and 1,300 in Bengal. So that that does not alter the position in the rest of India.

877. Do you not think that the demand for adult education could be stimulated?—I feel sure it is almost entirely a question of money, organisation and propaganda.

878. Has much been done in that direction?—I do not think the thing has been taken up at all except I think, Bombay had a small voluntary system run partly by the co-operative society; they have some adult schools in Bengal; they have a great many in the Punjab; but elsewhere not. I believe there has been some effort made in the Central Provinces but not attended with particular success. There may have been some defect in the management. An adult school is after all a very cheap thing. You move it from one place to another. You just keep it in a village till the local adults have been educated and then you move it on.

879. You agree that illiteracy on the part of parents is one of the principal reasons for the relapse of the child into illiteracy. If then by adult education you could render an important proportion of the parents in any one district literate you would in one stroke have removed one of the most important reasons for the relapse of the children into illiteracy?—Yes, you would.

880. Now is it not the case that that expenditure need not be altogether a recurring expenditure because I seem to see that in the next generation you would not have to face the same, as it were, capital expenditure in overcoming this inertia?—Quite true.

881. Is that not a very important possibility?—Yes it is.

882. Does it not suggest to your mind that it might be worth taking even financial risks in forcing adult education?—Yes.

883. In recommending and propagating adult education?—Yes, I think there is a great deal to be said for that; it would prepare the way for the ordinary primary education.

884. How about the education of adult females?—There again you are up against a further difficulty.

885. I want you to instruct me on that point. I am ignorant. How far, taking rural India as whole, is the *purdah* question an obstacle?—In rural India?

886. Yes?—I should say very little. It is gradually filtering through even at present. There are at present a good many girls in primary schools for boys, in some parts of India, for instance, in Madras. One-third of the school girls are actually in boys' schools; and in other parts of the country, for instance the Punjab, where it has been very slow, I believe they are beginning to filter into boys' schools; but there is still a good deal of prejudice.

887. So that with sufficient propaganda it might be possible to do a certain amount of adult education among females in rural areas?—I am afraid I do not know enough about the domestic duties of Indian women in these areas and whether they have enough time.

888. I am thinking of the importance to the child of having a literate mother?—The mother, I presume, has a good deal to do in the house besides looking after the children.

889. I shall no doubt have my perspective corrected during the next few months but from what you have been saying it does appear to me that you are spending a considerable amount of money and effort in trying to overcome the inertia of the masses of the rural population in the matter of education. You are moving that mass a little but you are not applying sufficient energy to produce any really dynamic tendency in the mass. If you could find the means and methods on the lines perhaps which we have been discussing to, in the ordinary language, get a move on, the next 25 years might show developments in rural education which to-day seem hardly possible?—Yes.

890. Do you think that is a reasonable view of the situation?—It means a concerted effort everywhere.

891. At every point and together?—Yes.

892. With regard to rural schools, you say on page 118 (at the bottom): "They should aim at sending the rural boy back to the land equipped to be a better farmer. Their whole orientation is at present wrong." Would you develop that a little?—I admit that is a rather strong expression, but I was thinking of it not only from the point of view of agriculture but also from the point of view of the schools. I will take it first from the point of view of the school. It is, as you know, an axiom of education that you should start from the known to the unknown. Well, the ordinary boy when he enters a village school enters an almost alien atmosphere as far as the subjects that he studies and the work he does are concerned. The books are the same for town boys and for country boys. The arithmetical problems are probably written by town teachers. The geography, as far as I know, in fact, I know, has very little relation to, say, the products of the neighbourhood. The nature study is almost negligible. I should doubt if they ever talk about jute in Eastern Bengal primary schools or about cotton in Lyallpur primary schools.

893. You mean you want something instead of arguments in arithmetic about wall-paper or about the hands of clocks and the lining of cisterns, and so on?—Quite so. From that point of view the education seems to be fundamentally wrong. It is no more difficult to study arithmetic through problems of practical application than through problems set by town teachers. That is from the point of view of education, primarily. From the point of view of the rural population I think we shall have to face the fact

that the great majority of boys attending primary schools will live all their lives on the land, and therefore it seems to me, although I do not propose in any sense to introduce vocational or even pre-vocational education in primary schools, that the atmosphere of the school and particularly the atmosphere of the rural secondary school should be with reference to the surroundings.

894. *The Chairman:* With regard to the publication of your memorandum, I do not know whether you have any objection to its publication, or would wish to modify it in any way?—Yes. I think the statement about a wrong orientation is perhaps rather too strong an expression.

895. We will bear that in mind.—Thank you.

896. How many so-called intermediate colleges as recommended, I think, by the Calcutta University Commission, have been founded?—There are no intermediate colleges exactly in the form suggested by the Calcutta University Commission actually in existence. They anticipated a separate institution with a somewhat vocational bias after the high school. Actually intermediate colleges have been opened in the United Provinces simply by the addition of the intermediate classes to the high schools, and in the Punjab by taking off two of the high school classes and adding two of the intermediate classes from the colleges, making four-class institutions of that kind; but none of these institutions can be said to have the vocational options which the Calcutta University Commission recommended.

897. What is the essential purposes which these classes fulfil?—One view of the Calcutta University Commission which has been accepted by those who started intermediate colleges is that intermediate education is really of a secondary school character and should not be attached to degree colleges. The other, which is more expensive and which would develop these intermediate institutions into vocational educational institutions leading to various professions, has not been accepted, I believe, except in so far as there are a certain number of teachers' classes in the intermediate colleges.

898. Do any boys who pass through these intermediate courses go in for degrees?—As a rule they go in for degrees; the only change has been to separate the management and staff and also to treat the teaching of those classes more as school education than as college education.

899. The Calcutta University Commission, if I understand the matter aright, rather had in mind the idea that these intermediate colleges would fill a want, in that they would provide a completing course for boys not going in for University degrees?—That is clearly what they intended; they clearly intended that they should be of a vocational character.

900. So that the recommendation of that Commission has not been given effect to in regard to this matter?—It has not been carried out in that way.

901. Now, on a very different question, do you think that all is being done that should be done to teach hygiene in schools?—At present it is an optional subject in the high-school departments, and as such I think it depends for its popularity a great deal on whether it is or is not considered an easy subject for the matriculation examination.

902. You are speaking of hygiene?—Yes; it is not taught in the middle schools except in girls' schools. It is not taught as a regular part of the course except, I believe, in a somewhat desultory manner in some Provinces; but it is not a regular compulsory subject.

903. Is any attempt being made to inculcate the rules of health in primary schools?—I cannot say. I am not sure. A certain number of maxims are hung up on walls, but whether they have any effect on the boys or not I do not know.

904. That is as far as the matter goes?—In primary schools, I think, there is nothing more done, Sir.

905. It has been suggested in some quarters that the teaching in pure science which is open to an Indian boy in India falls short of the ideal standard. Would you care to say anything on that point?—The standard differs very much, I think, in different Provinces. In Bengal there is practically no science teaching in schools at all owing to the expense. It has not been traditional; a boy who takes science there starts it when he goes up to college, not before. Some Provinces, on the other hand, have very well-equipped science laboratories; as to the actual curriculum itself, I am not a scientist and so I cannot say; but I know that we had a specialist out from England in the Punjab who did a great deal towards modifying the science course in high schools and making it more practical, not quite so much merely experiments with test tubes but a little more adapted to every-day life.

906. In view of the policy of Indianisation of the Agricultural Department, you will probably agree with me that teaching in pure science in India is of great importance for the future of Indian agriculture?—Yes, certainly

907. Now, I would like to ask you a question on a subject of more general application, as to the relations between the Imperial Department and the Provincial Departments of Education. Are you satisfied that they are as close as they ought to be?—There is no Imperial Department of Education at the present moment.

908. Between yourself in your capacity as adviser and the provincial organisations?—There used to be a Central Advisory Board on which we had representatives from the different Provinces, which met together twice a year at least and considered general educational problems and published their results. I understand they were of great value, at least we were so informed by the Directors; but the Board was abolished as a measure of retrenchment in 1923.

909. What is your own staff?—I have no staff, except that I am part of the Education Department and I simply use the particular branch of the Education Department concerned; they abolished the Board and all my own staff.

910. I will make plain to you what I have in mind. It may be that if a progressive policy were to be adopted in education, it would be considered necessary to correlate very closely the activities of two more Provinces. How would you bring that about?—At present there is no machinery, of course, and there would be a certain amount of difficulty owing to the fact that education is a transferred subject and the Ministers of two Provinces might not see eye to eye. In the old days it was quite possible to correlate a great deal, because the Government of India gave out money and by giving out money naturally encouraged lines of development which it wished to see adopted. For instance, it gave very large sums one year for the training of teachers on condition, of course, that the Provinces also did something towards it. Now a-days the Government of India gives nothing towards education in the Provinces and therefore it has no power or influence.

911. You will understand that I have formed no view as to the possible necessity of such correlation. I merely wanted to know whether in your mind it was a possible need in future?—I have always thought there was a great deal of wasted effort. We have experiments going on in contiguous Provinces; one fails completely and it is started in the next Province which probably knows nothing about why it has failed; in fact they do not even know that it has been tried in the adjoining Province. The only documents that we get are the Directors' Reports, which are sometimes, naturally, rather dull, statistical documents and they do not deal at length with any experiments that have been undertaken. As a matter of fact the knowledge of this Punjab scheme for agricultural education was really spread, I think, by the Board of Agriculture (which is not a provincial body) which met at Pusa and they recommended it to Directors; otherwise I do not suppose it would be known in other Provinces.

912. Do you have anything in the nature of a conference for all India on educational matters?—We have not had a conference since the Reforms.

913. There again I have formed no view, because I am not familiar with the facts, but it strikes one, coming into the country for the first time, as very extraordinary that you do not have a conference?—I may say that the Government of India have, as a matter of fact, actually issued a letter to local Governments only last week suggesting that there should be a conference of the Directors of Public Instruction next January, not to discuss policies, but to discuss their common difficulties and problems and their own experiences. We do not know, of course, what replies we shall get from the Local Governments.

914. You think that annual or biennial conferences might prove useful?—Very useful indeed, and I am sure the Directors of Public Instruction would welcome it. Of course, I meet Directors, because I tour all round India. I have just been to three Provinces, and I found them very anxious to hear what was being done elsewhere.

915. There is great unevenness in view and classifications and practice between Province and Province at the moment, is there not?—Very great indeed.

916. And that is to be deplored, is it not?—Not in every way, because we do not want too much rigidity. In some ways of course there might be a good deal of mutual help.

917. Do not you think that India has been passing through an experimental stage in this matter?—If there is any sign of it uniting on points where it might unite with advantage, I should say so, but it seems to me there is a tendency, possibly, to widen the differences in educational details and administration unnecessarily.

918. You not do think that the present position is an experimental stage and is now reaching its conclusion, and that there is sufficient material on some of the main issues, at any rate, to come to a firm decision?—The difficulty is, who is going to enforce that decision? We used to discuss at the Central Advisory Board certain problems such as the stage at which English teaching should be commenced in vernacular schools. We perhaps arrived at a unanimous decision, but all we could do was to circulate a record of our discussions and the results, which might not commend themselves to the authorities of the Provinces. That is the whole difficulty.

919. It is easier to spread words in any country than 'actions', is it not?—Yes.

920. *Dr. Hyder:* Before I begin my questions, I should just like to be quite clear on a question which was put by the Chairman, and it is this. When the Advisory Board was abolished, you called a conference of the Universities?—I had forgotten that. I was thinking more of the subject under discussion, *viz.*, schools. There was a conference of the Universities held two years ago.

921. Since the Universities are independent in the Provinces, and are also independent more or less of the Directors of Public Instruction, I think it would be better to have at the headquarters of the Government a Board of High School and Secondary Education. Would that satisfy you?—I should like to have a simple Advisory Board. It need not necessarily be confined to high schools or primary schools, but it might discuss questions like agricultural education, the education of defectives and so on.

922. So that it will be useful to have inter-University conferences and something like a Board composed of Directors of Public Instruction from the different Provinces?—Or such representatives as the Provinces might choose to nominate, yes.

923. Now I want to ask you a few questions relating to education and agriculture in their relation to unemployment generally. We have here purely literary education, and then in the Provinces and at some central institutes specialised education in agriculture is given. What I want to know is, whether there is any opening for boys who come out of these agricultural colleges apart from Government service?—Unless they come of wealthy families (the sons of landowners, for instance), I should say none.

924. Taking up the educational system, apart from agricultural education, I believe you would agree with me that it is really like a bamboo tree. There are so many joints. It has very many different examinations and at the top people congregate with degrees. So that there arises out of this educational system the question of unemployment of the educated people. Now, apart from Government service, there is very little opening in the country for the educated graduates of agricultural colleges?—I should say there is very little opening for them. I understand from the United Provinces Report that there is some employment for them amongst the talukdars, but they are not graduates; they are people who come from the college at Cawnpore which goes up to the Intermediate stage.

925. Has that got something to do with the fact that the educational system does not fit in with the economic system, and the economic system does not fit in with the educational system? This is a country of small peasant cultivators and peasant proprietors. You turn out graduates from your agricultural colleges. They cannot go back to agriculture because the holdings are small. The only way open to them, therefore, is Government service. Is that so?—Yes.

926. They cannot act as estate agents or estate managers, because the landowners require men of a different kind; they require men who know the art of collecting rents and so on?—I should say that the chief reason why the big landowners do not employ agricultural graduates is because they would come with ideas of spending money and launching out into expensive schemes. That is probably why the ordinary landowners do not want to employ agricultural graduates. The landowners do not want to put more money into their land. There are of course a few educated landowners who do employ agricultural graduates, but their number is very small indeed.

927. What I was referring to is this. Take a Province like Bengal. There they have large estates and small holdings. There your agricultural graduates cannot find employment as estate managers or as cultivators of small holdings?—I do not understand why the large landowners should not put more money into their land, instead of living in Calcutta, and improve their estates both for the sake of their tenant holders as well as for their own ultimate benefit.

928. Now, in Bengal you have tenants either on produce rent or tenants paying a fixed rent. If the tenant is on produce rent, he has got to share the produce with the landlord, and he does not want any agricultural improvement because he will have to part with a portion of the extra produce. If he is on fixed rent, then of course there arises the question what agricultural improvements can be effected. If they relate to crops, if they relate to prevention of disease, if they relate to agricultural improvement, then it is in the interests of the peasant to adopt these improvements. But the landlord cares very little about these matters because the extra benefit is not going to him. Would you agree with that?—That is rather condemning the landlords. What I mean is, landlords in other countries do not necessarily look at the question entirely from a pecuniary point of view. If they are moved entirely by mercenary considerations, that would be the case.

929. I am trying to find out why it is that the educational system does not produce more useful results in agriculture?—Your statement would be perfectly correct granted the assumption, of which you will probably be able to

know the truth better than I can, that the landlord in Bengal cares little for his peasantry.

930. There is only one class of improvement in which the landlord can be interested and that relates to improvements in agricultural engineering, and if land is reclaimed or afforested, permanent improvements might be effected, and then of course the landlord can enhance his rent; otherwise not. But what I want to ask you is whether any instruction is given in agricultural engineering in your agricultural colleges?—I am afraid I am not sufficiently conversant with it, but as far as I know, there is no special course in our colleges in agricultural engineering, but whether it is included in the general course, I cannot say off-hand.

931. There is no instruction given at these agricultural colleges on rent and revenue matters?—I should say that it is one of the greatest weaknesses; agricultural economics should be taught.

932. So that we come to this really, that your agricultural colleges give specialised training, but they do not equip the boys to go out into the world and get employment somewhere, because agricultural engineering does not form part of their training, and also training in legal, rent and revenue matters is not given in your agricultural colleges?—As I said, I do not consider that it is the function of the agricultural colleges to turn out people so as to enable them to learn a living as farmers. I do not think that has been a success, as far as I know, anywhere. I think the function of the agricultural colleges is to turn out men who can work as teachers in agricultural schools, and also to provide experts. A lower grade of education is needed for the training of actual agriculturists.

933. I was referring to people who either go out into the world as teachers or are absorbed in the Government departments or who go out into agricultural industry itself and who might be absorbed as estate managers of big landowners. I was referring to the case of such people?—I do not know how far the colleges turn out such people elsewhere. But I think in India the agricultural colleges turn out people to work as experts and demonstrators. But, as I said before, there is not sufficient outlet for agricultural experts in other departments, though they might be quite useful. There is really no reason why agricultural graduates should not be introduced into the Revenue Department or the Irrigation Department or the Co-operative Department.

934. They might be absorbed by the Court of Wards as Tahsildars or Naib Tahsildars?—There is no special merit, as far as I know, about the Arts degree in preference to a degree in agriculture.

935. Now, there is one more matter. Denmark is a very great country as regards agriculture, and it is very curious that Denmark does not possess agricultural colleges, but it possesses an excellent system of high schools which impart instruction of a purely literary character. So that if we could increase literacy and also the culture imparted in our secondary schools, you would be on surer foundation as regards the improvement in education and agriculture?—As you probably know, the Folk high school is only a short term school. It lasts for four to nine months in the year. Owing to climatic advantages (I say advantages, but they would probably call them disadvantages), countries like Denmark, Canada, Sweden, and the United States are able to keep their high schools open at a period of the year when there is no farming going on, but we unfortunately have no season like that as far as I know.

936. For instance, the hot weather?—I do not know. The solution in Ireland and Scotland is as far as possible to work in the winter season. The Glasgow degree is taken in three winters only; there is no summer work at all.

937. With regard to the staffing of these primary schools and secondary schools of a literary kind, would you agree with me that the *personnel* should come from agricultural people and not from townspeople?—For agricultural

schools, as far as possible, they should come from the agricultural people, but I would not hold up education till you have agriculturists educated enough to teach. That is the difficulty.

938. *Sir Thomas Middleton*: I have only one or two questions of detail. On page 114 of your memorandum you refer to the college founded at Poona, in the Bombay Presidency, and indicate that the date was after 1905. Was any substantial change made in the course at Poona when the college was transferred from the College of Science to a new separate building? Was not the college at Poona founded about 1893 or 1894? I think the building was altered but I do not think there was any other substantial change?—Yes, perhaps I generalised too much there.

939. Now, on page 118 in the sub-paragraph (c) you say: "Every boy in the middle department passes through a four years' course in agriculture." Would you indicate roughly the ages of the boys when they enter that course?—Yes. I happened to look it up just now; I thought the question might be asked me and I verified it. The average age of entering the middle school is 11, and the average age of leaving would therefore be 15.

940. On the same page, you say that unfortunately for financial reasons the Punjab scheme has been modified. I would like you to explain your views on the sentence in which these words occur?—Yes. There has been a great deal of experiment in the past with school gardens and the half-acre farm, I consider, will probably degenerate sooner or later into the school garden and be little more. The object of the scheme of three-acre farms is to make it as far as possible similar to the actual holding which the boy will have afterwards. One obvious difference between the farm and the school half-acre plot is that in the one you have the use of cattle in ploughing and in the other not. That brings in animal husbandry; to a small extent; still, it is something, at any rate. And again, the half-acre plot would be very likely to degenerate into small gardens more like market gardens. The only one I have seen recently was very much of the type of a market garden with little bits of cabbages here and little bits of other vegetables there, whereas the three-acre farm allows you to put a really appreciable amount of ground under corn, and so on.

941. The intention was to introduce the economic idea?—Yes, to try as far as possible to make the holding correspond to what the boy would have afterwards, not so much with the idea of teaching him agriculture as of making the thing real.

942. I quite understand. The boy grasps a lesson much more easily when he sees it on the real scale than when he has it illustrated in miniature?—Yes.

943. It is the educational object which you have in mind?—Quite so. If I may make a parallel, it is the difference between kindergarten work with cardboard and paper and manual training with wood when you really make boxes.

944. Then, I am glad to see that you yourself are of opinion that the Punjab scheme might be widely extended throughout India?—Yes, I am naturally in favour of it. I organised it and have a natural prejudice in its favour.

945. *Sir Ganga Ram*: I want to ask you whether you have thought of all the avenues of employment for the output of the agricultural colleges?—Unless you are going to extend and enlarge them very much I still think that there will be a good demand in the near future, especially if we go in for an extension of agricultural education, for the output of these colleges.

946. Well, allow me to tell you that my experience is that a landholder will never look at the output of the agricultural colleges if he comes straight from the college?—I feel sure of that.

947. He must have some practical experience before he is any good to the landholder. For that reason I got the Punjab Government to give 2,000 acres on a three years' lease to the boys; but that is not enough, because that only

will accommodate two or three. We hope that with the extension of agricultural education our output will be very much greater. But I may tell you that that idea ought to be knocked on the head that landholders will ever take boys fresh from the colleges unless they have had some practical experience where they have worked for themselves and to their own profit and loss. So allow me to tell you that that scheme has been sanctioned which I have mentioned. It is good for three years, but that is not enough. The new scheme I have suggested to the Punjab Government is that they should, instead of selling crown lands wholesale, reserve, say, a thousand acres a year for ten students every year (or say more; that is a question of detail) and lease it to them at the rate of 4 per cent on the market price. What do you think of this idea?—It is rather difficult for me to say off-hand. It depends on the economic implications.

948. I have submitted it to the Punjab Government and they are considering it. But what I want to ask you is: in the Punjab you have got a lot of crown land which can be disposed of in that way, but are there such lands in other Provinces?—I cannot say. I am afraid I do not know enough about land.

949. But I go still further and say that, if you have not got crown lands, Government might take a large area on lease or something like that and then parcel it out to these boys in small plots of say 3 acres each?—It sounds to me very promising.

950. The next question is: Is the qualification for admission the Matriculation in all the colleges?—Yes, I think it is.

951. Do you not think that if we raise the qualification it might help to resolution? Nowadays I hear from professors that they send boys up for the Matric, at a very tender age, the age of 15 in the Punjab. That is a very raw age. So, do you not think if the qualification of admission was raised from Matriculation to F.A., it would be a good thing?—Yes. I would not say F.A. I should suggest F.Sc. the Science Intermediate.

952. And then in the F.A. class they could take away certain subjects which are more or less general in character?—Yes, I think there is a great deal to be said for that. After all, the engineering colleges' admission qualification is the F.Sc., and the medical colleges' admission qualification is the F.Sc. [It might be the F.Sc. in this case as well.]

953. Just as in the Arts colleges we have a medical group we will have an agricultural group. And for this reason I want your support for this proposal which I have sent to the Universities, that agriculture may be considered as a compulsory elective subject in the F.A. Do you agree to that?—No, I am afraid I would not agree to that at all.

954. I mean, just as in the case of Biology, so they might accept agriculture also as a compulsory elective subject?—I once was on the committee appointed to deal with a question raised by the Khalsa College as to whether an ordinary Arts college should or should not be allowed to teach agriculture. It is a very thorny subject and there was a good deal of debate about it because they thought it was likely to degenerate into book teaching. The Khalsa College were able to produce evidence that they were doing it on a proper scale by taking up a very large acreage, and employing agricultural graduates. The tendency, if you once allow agriculture to become an optional subject. . . .

955. *Sir Ganga Ram*: Not optional, compulsory?—Well, either. A subject in an Arts college tends to be reduced to mere book work, and you turn out a certain number of intermediates in agriculture who really are not qualified by practical work.

956. I only mean to introduce that subject as an elective subject on a par with Zoology and Botany and so on?—I do not think I could agree to that. I think it is a professional subject.

957. Is the syllabus in all agricultural colleges the same?—No, it is not. The course is laid down in every case by the local University. In Bombay it is only a three years' course.

958. The text books are the same?—All the text books are not the same.

959. Is there any truth in the remark made in the Census Report that the boys who go to a rural primary school forget everything two years later?—I think it is probably true. In fact, I am pretty sure it is true, because on visiting schools lately where compulsory education has been introduced I found quite a number of boys who had come back to school and quite a surprising number who had been in school for a year or two years had, I am afraid, to go down to the bottom and begin all over again.

960. Do you feel the necessity of revising your present text books with an agricultural bias?—I am very strongly in favour of it for the rural districts, for use in rural schools.

961. With arithmetic dealing with agricultural standards, and pictures of ploughs, etc.?—There are any number of problems that can be set on agriculture.

962. Would you be in favour of introducing some sort of easy mechanical training in rural schools? For instance, instruction in how to do necessary little repairs to a plough, etc.?—Where agriculture is taught I suppose it ought naturally to come in.

963. A little mechanics of that kind?—Yes, simple mechanics.

964. Do you do that now?—I suppose ordinary repairs to ploughs must be done.

965. In the colleges (I know a little of what is done in the Punjab but not in the other Provinces) do you teach them a little of ordinary mechanics, *i.e.*, the ordinary rules of finding out what power is required to lift so much water to such a height? I mean lift irrigation?—I cannot say.

966. Do you also teach them in the agricultural colleges what depth of water is required for each crop?—I have not the curricula before me.

967. You are in favour of that sort of education in agricultural colleges?—Naturally.

968. At present they know nothing about it. All that can be done in six months' training. You can begin with oil engines to start with and the principle of pulleys, how to reduce the velocity of a pulley from one to the other. That is simple mechanism. You are in favour of introducing that sort of training?—Yes, naturally. I am in favour of anything which could be done without overloading the course and which will be of practical value.

969. *Sir Henry Lawrence*: When the Poona College of Agriculture was established in 1905 was not the course changed from the course for a diploma of two years to a University course of Bachelor of Agriculture?—I read something of the history of it when I was writing this note, but I cannot remember now the date when it changed.

970. About that time. *Sir Thomas Middleton* asked you if the course was not the same but I think the course was lengthened and the University made it a condition for recommending it as a Degree course in Agriculture?—Yes. I think that in Poona the course is still only 3 years. I am very sorry that both in Engineering and in Agriculture they have not lengthened their course to 4 years. It is the only college in India in which Agriculture and Engineering have a three years' course. In Engineering I am glad to say they have postponed their entrance and made it a year later now. If you want to get at the absolute standard of the degree, the Poona degree must be considered one year shorter at any rate than the others; whether it is lower in standard I do not know.

971. Do you think it ought to be increased?—I should think so. I do not know sufficient about Agriculture, but I know that there is a feeling about Engineering. The difficulty is that the University has a say in a matter like that. The University is content with a three years' course.

972. Has the Poona College got an Agricultural Engineer on its staff?—It is 3 years since I have been there. I cannot say at the moment.

973. Is there a Professor of Agricultural Economy?—I have not got the prospectus here with me. I do not know.

974. *The Raja of Parlakimedi*: There is a large percentage of boys who do not take up higher education after their School Finals?—A great many fail at the School Final or Matriculation. A good percentage of course cannot afford to go on.

975. Do you not think that if you made agriculture a compulsory study in that class, it will be helping these boys to take to agriculture as a vocation?—My experience hitherto of agricultural teaching in high schools has not been very encouraging. It has nearly always been difficult to get it beyond the level of book-teaching. The difficulty is the examination. If you are going to make this a compulsory subject for the Matriculation or the School Final, it must be a paper examination only. It will be impossible to employ a large body of men to go round and inspect the practical agricultural training of a large number of boys. Therefore, it becomes purely a literary subject, which it should not be.

976. It is now being insisted on that secondary schools should have their gardens close by. They can be made use of for practical study?—I would rather have that than have it made a subject for examination. The instant you introduce examinations, you introduce also text books and cramming.

977. In the lower forms, nature study is practically a compulsory subject?—Yes.

978. There are now several subjects such as book-keeping and so on in the School Final. If private institutions can afford to have gardens near by and there are qualified teachers, I think there would be no difficulty if it was made a compulsory subject?—When I was in the Punjab 50 high schools took agriculture for matriculation. I made inquiries and found out the reason for that. It happened to be a particularly easy subject. Only a limited number of books had to be studied on the subject for that standard and it was impossible to prescribe a practical test. It was to avoid that that I suggested introducing this form of practical agriculture in high schools, but it fell through for lack of funds, and I am doubtful whether it would have been a success. I think that every boy who gets up to the high school stage has more or less definitely made up his mind that he is not going to go in for agriculture. Of course the matter is quite different if he is going into an agricultural college.

979. You have just said that there are not books enough on geography to give you an idea of the produces of countries and Presidencies. May I bring to your notice that there is one book on agriculture written by Mr. Morrison, which has also been translated into the different vernaculars? This book gives you an idea of the different products, monsoon and so on. I think it should be recognised by the Imperial Government as a sort of book which can be taken into the different Universities. After going through it, would you make a suggestion to the Government of India to that effect?—I should like to see it. I have not yet seen it.

It is Mr. Cameron Morrison's book; Macmillan and Co. publish it.

980. *Sir James Mackenna*: What are the steps preliminary to the affiliation of an agricultural college to a University?—The application to the University informing them of the qualifications of the staff and the course which it is proposed to follow. Then the University would send down a board of inspection. But the college has to be opened before it is affiliated. That is the difficulty about all these institutions. Before they are recognised they have to start as unrecognised institutions.

981. I suppose that in certain cases, if the University Committee found that any section of the teaching staff was not up to the standard or the teaching staff was inadequate, they would ask the college to fill up the gap before they considered the application?—They would lay down so many requirements. As a matter of fact, I have served on several committees. What they look into is the library, the buildings and the qualifications of the

members of the staff. They often say, if such and such a scientist with such and such qualifications is appointed, if the library is increased by so much, etc., they will be prepared to affiliate.

982. I may take it that the standard required for affiliation of an agricultural college to the University is as high as that required of any other college seeking affiliation?—You have a case in point from your own Province. The University will not take in the Agricultural College there. They do not consider the standard of admission high enough.

983. Therefore, your graduate of an agricultural college is really as good for employment in any department as a B.Sc. or a B.A.?—Yes.

984. *Mr. Calvert*: What is the explanation of the small proportion of boys in rural primary schools who pass through the fourth class?—The explanation is the inefficiency of the school largely and partly the boys being withdrawn by the parents owing to this inefficiency after a very short time. The boys can never be got to stay on until compulsion is introduced. The effect of compulsion will be to raise the number of school-going boys which means you will have to increase the staff. The schools will become more efficient in that way.

985. Has the demand for child labour any thing to do with it?—Very little, I think. It is constantly stated that you must at least have the holidays during the harvest season and that the boys are taken away for herding cattle. I have inspected a very large number of primary schools and I found that only very few of the boys are herding cattle. The others are crowding round the door or looking through the windows (of the school). The actual number employed on herding cattle, etc., is not very many, certainly not of boys of school-going age.

986. Do you agree that all subjects should be taught in relation to rural life?—I have already stated that this should be done as far as possible.

987. In the school at Moga would you say that the secret there was the extraordinary correlation between the tuition and actual rural life?—I should say it is. It is more in the nature of a community centre. They have all sorts of activities centred round the school, like they do in America.

988. Everything is really taken from the village?—Yes.

989. Do you consider that the spread of rural education must wait upon the attainment of a higher standard of living?—I should say that we should wait indefinitely if that were to be the case. The two must go together.

990. Should the Education Department recruit members of the district inspecting staff from the rural or agricultural population?—I would say that the fact that the man is an agriculturist should be a qualification in his favour, but I would not make it a *sine qua non*. In fact, you would never fill your inspecting staff sufficiently if you waited for agriculturists.

991. Is there a scarcity of vernacular books suitable for village reading? What has been the result of offering rewards? Can you suggest remedies?—There is a very great dearth of those. That is one of the difficulties of the village libraries, that there is at present little or no output of books for boys or even for peasants to read. It is a very serious drawback. The only thing possible is to subsidise production as far as I can see.

992. Is practical instruction in agriculture in elementary (primary) schools optional, compulsory, or not yet introduced? What is your experience of its value?—There is no practical instruction in agriculture in elementary schools. I think I did mention it and I have no belief in it at all.

993. Do you accept the dictum that agriculture as such cannot be taught in schools?—I do not quite know what you mean.

994. That apart from the mental discipline and cultural value of such training, agriculture cannot be taught?—I think it is much more than that. I think that agriculture as taught in the vernacular middle schools is a good deal more than that. It must be of practical value. I should like the boy who leaves at the end of the middle school to be no worse a farmer than the

boy who has not been to school. I do not say he will be better but he should be no worse.

995. *The Chairman:* In his knowledge of practical agriculture?—Yes. At the same time he should possess arithmetical and general knowledge which will make him capable of going further.

996. On the other hand, his mental alertness and capacity should be higher than the boy who has been to no school at all?—It should be very much higher.

The Chairman: That is really Mr. Calvert's point.

997. *Mr. Calvert:* Do you consider that the elements of agriculture can be taught to sons of cultivators in the vernacular?—It must be in the vernacular, certainly.

998. The point raised in one Province was that you cannot teach agriculture in the vernacular?—I should say more probably the difficulty is you cannot inspect it in the vernacular. I find that when they object to it, very likely inspectors are not used to following the local language. It is much more likely to be that. It is very difficult to tell whether the education given in the vernacular is efficient or not.

999. *Mr. Calvert:* That is a curious statement made in one of the memoranda, that you cannot teach agriculture in the vernacular?—That is quite absurd.

1000. *Dr. Hyder:* Are not Dr. Clouston's books translated into Marathi and other languages?—Yes.

1001. *Mr. Calvert:* Does the inclusion of agriculture in the middle school curriculum place any obstacles in the way of the attainment of a certificate qualifying for public service? Or in the way of proceeding to higher education?—It does not in the Punjab; but you mean if this system is adopted elsewhere there will be a certain amount of opposition to it. That is a difficulty. It has been made clear that agriculture must take the place of a classical language. There are certain Provinces which insist on a classical language. If you are going to insist on a classical language, you have to give up agriculture.

1002. It does also compete with English?—Very little; it does a little.

1003. In your scheme did you propose to apply your agriculture only to vernacular middle schools or to Anglo-vernacular schools as well?—No, I think all differentiation will soon disappear. English is being taught more and more in vernacular middle schools.

1004. Is there any local interest aroused in the school garden? Can you suggest means to increase such interest?—All reports about school gardens, I am afraid, are very disheartening. It is only when you have a real enthusiast in charge of a district, like Mr. Fremantle at Allahabad, that the school garden succeeds.

1005. Should rural teachers be specially trained? Should there be separate training schools for this purpose? Should these be situated in rural areas? Should they be staffed throughout with teachers from the agricultural classes?—To the last part I should say No, because we could not get teachers. The other part is very important. At present the normal training school course for the elementary teacher is the same for towns and country, and the elementary training schools are very largely planted in large towns. The rural boy coming out from the vernacular middle school where we hope he has gone through his agricultural course then becomes a teacher. He is transplanted to a city area where he has to dress as he would not dress in the country, where he has to live an altogether different kind of life; and apart from that he has to go through exactly the same course as a boy who is going to teach in the primary department of the town high school. If you are going to ruralise, to agriculturise your rural schools, you really would have to go in for a separate course of training for teachers for the rural schools. I think that is quite essential. All the books will have to be different.

1006. It is quite easy to convert some of the schools into purely rural schools?—Yes.

1007. Is there in your Province a text book on nature study, or school gardening or rural science? Do you consider them satisfactory or can you suggest improvements?—There is a very great lack of decent books on nature study and in fact there is very little indeed done in the way of nature study. Most of the nature study is of a more or less perfunctory character.

1008. In your scheme where agriculture is going to be taught in middle schools, would you send your teachers to the agricultural college for a short training?—Yes.

1009. Is a specialist in nature study required? Should teachers of nature study in training schools be graduates in natural science or in agriculture?—I presume you mean teachers of agriculture. At present they are taught for one year in Lyallpur and my own impression is they ought to be taught for two years or brought up for periodical courses.

1010. Your scheme is for a teacher trained in pedagogy with a short course in agriculture?—A one year course in agriculture. Of course he is an agriculturist by birth but I think it would be quite as well to put in two years. The subject of rural economics, for instance, is not taught at all. I do not believe any attempt is made to teach this subject, which seems to me to be a very important one.

1011. What is your experience of adult schools or night schools for (a) spreading literacy and (b) preventing the literate from lapsing back? Have you found lantern lectures, cinema lectures, etc., valuable? Can you suggest developments and improvements?—It is very difficult to say at present that the present schools are entirely devoted to spreading literacy or to preventing the literate from lapsing back. Of the ones I know, the Punjab ones, it is too early to say anything yet; they have only been in existence for two or three years. We cannot tell how far they are going to keep the man literate unless they are followed up by libraries. You must provide something for your reader to feed on.

1012. What is your experience of village libraries?—I know very little about them. I understand you are doing something in the Punjab. We have had a very unfortunate experience in the United Provinces where it was left to the District Boards and they are gradually petering out. We have no explanation except that the District Boards take no interest in the matter which is a great pity.

1013. Do you think that the cause of rural education would be promoted if on the administrative side you had complete separation between rural education and urban education with separate inspectors right down the line?—I don't think it would be practicable. It is very difficult to say but I should think it would be quite impracticable. Secondary schools start with the ordinary middle school course and go on into the high school. The high school is more or less urban in character.

1014. The present combination leads to peculiar results. In the Punjab an adult school run by an urban inspector was entirely devoid of rural pupils but when run by an inspector from an agricultural tribe it became entirely a rural thing?—All you can do is to transfer the men backwards and forwards to get both sides. That is the difficulty indeed. We have to keep on moving our inspectors.

1015. You do not think it is practicable to separate the two?—I do not think so.

1016. *Mr. Kamat:* You said that in other countries the function of agricultural colleges was mainly to train students for research or for Government departments?—Yes. I think I must qualify that. I have recently heard about Germany, and I understand the German colleges are now restricting admission to men who have had at least 2 years farming experience. That was only communicated as a warning to Indian students, so that I do not know much about it.

1017. But as this country is predominantly an agricultural country should we be satisfied with that sort of ideal?—The standard of agriculture is so high in countries like Denmark that if they are content and if they think their best men will be turned out after a very much lower standard of training, I do not think we can do better than follow their example. Why try to turn out an expensive article if a thoroughly practical agriculturist can be turned out for very much less?

1018. You would not take into special consideration the fact that as this is an agricultural country we require more agricultural graduates than the foreign countries you refer to. You would not give any weight to that fact?—I think the agricultural graduate is very useful but I do not think he is primarily the article that you want for farm work.

1019. In the Poona Agricultural College, agricultural economics is being taught; I think there is a Professor teaching it. Do you think in the other agricultural colleges of India agricultural economics could be taught with advantage?—I should not like to generalise as to whether it is taught or not, but my own conception is that it is not taught to any great extent.

1020. Would you not consider that an essential subject for an agricultural graduate?—I should.

1021. It has been remarked that in most of the Provinces where there are agricultural colleges, about 10 per cent (or somewhere near that figure) of the graduates go back to farming. Taking things as they are in this country, can you suggest any remedy to get over that difficulty?—I still do not think that the agricultural graduate is intended to be a farmer, except perhaps when he is the manager of a large estate.

1022. Then about this question of men who have taken primary education lapsing into illiteracy, regarding the schools in Bengal and the Punjab, are they necessarily night schools?—It is the most cheap and most convenient form. As far as I know they are all night schools. People go there after their day's work. The idea of an adult school is to capture a man who is actually on the land or in business. There are also two other conveniences: They are generally held in the public school building in the evening and they are generally taught by the day school teacher for a small allowance.

1023. As far as my recollection goes, about the remarks in the annual reports, as regards night schools in the Bombay Presidency, I think with very few exceptions, these night schools have been said to be a failure in Bombay. Have you any special feature in your mind which has made the Bengal or the Punjab adult schools a success?—I do not know anything about the Bengal schools. When you refer to your night schools in Bombay, you refer to these rural schools in the Poona district. They have been a failure.

1024. Yes, except a few schools near the factory which attract the factory labour?—When I was in Poona some years ago, they were supposed to be a promising success. I cannot tell you about the Punjab schools which are in existence for the last two years or so. It is too early to say whether they are going to be a success or not.

1025. I am asking whether you have in mind any special feature of these Punjab schools which has made them a success?—As far as I know they follow very much the lines of the Bombay schools, conducted by the teachers in the school houses and moved on from time to time.

1026. Except these adult schools, have you any remedy in view to prevent people lapsing into illiteracy?—As I have said before, compulsory education. When you can introduce it, you can make quite sure that at least the boys will finish their four-year courses and will not waste two years in school and go away. The other is the provision of village libraries and encouragement of local reading.

1027. In order to speed up literacy, is there any form of encouragement which could be given to these aided schools?—I am very sceptical about encouraging aided schools. I have lived in Provinces with both systems. Aided schools mean less efficiency, a very much larger number of schools for the

same number of boys, and poorly paid teachers. For a special community, for instance the Mahommedans in Sind, there are advantages; otherwise I am very decidedly in favour of the school under public management.

1028. As most of the Provinces are finding it very difficult to find the finance for opening primary schools according to regulations, would you not sacrifice a little bit of efficiency and give some special facilities to these aided schools in order to speed up literacy?—I went into that question very fairly deeply when I was Director of Public Instruction and I found as a matter of fact that aided schools are generally started in centres where there are already schools. The test for education is there. What you are merely doing in many of these cases is simply aiding a school which takes away pupils from other existing schools or at any rate increases numbers very slightly. I think you will find that most aided schools, except perhaps in Bengal where villages are very close, are founded in centres which already have educational institutions. I am quite sure that the aided school never touches the outside rural district. Who is going to start a school in a remote village in the hope of inducing boys to go to school? It is not a paying proposition. You must remember that the master of the aided school is out to make money. That is his job.

1029. But as he cannot make enough money would you not supplement his earnings in the village by some special grant?—I do not think he will go to a village, unless it is a purely religious school.

1030. *Sir Henry Laurence*: What was your reference to the Mahommedans in Sind?—Aided schools may be suitable for special communities, for instance, to meet the particular desire of the Mahommedans in Sind it may be advisable to aid *mulla* schools rather than to start other schools. That, I say, is a justification for the aided school.

1031. *Dr. Hyder*: In reply to the Chairman, you said you did not know much about the *purdah* system. I ask you whether you can say from your experience of eighteen years in India whether, if the conditions of life were improved and education were introduced generally into rural areas, these people would not take on the manners and customs of the people they consider more respectable; that is to say, they are at present without *purdah*, but they would walk into the *purdah* if their conditions of life were better?—I think that is very probably true.

1032. *The Chairman*: I think we should have on the notes your view as to the advisability of applying compulsory education?—It is a very difficult subject. I think myself that it can be introduced much more widely than it is introduced if there is a little more course shown about it. I do not like always that the means for introducing compulsion are made easy. I do not like always to quote the Punjab. I started the present system there. They have made the means of introducing compulsion in individual village areas so easy that it has caught on decidedly. In a village one or two advantages are seen. As soon as you get compulsion you get a certain number of children in the schools. You may have a school with twenty children spasmodically attending. If you introduce compulsion perhaps there will be fifty or perhaps the number would not rise to more than thirty-five. As soon as you get thirty-five children, you get your second teacher. The school then becomes more efficient. You have to do intensive propaganda more than anything else. Hitherto most Provinces have been afraid to undertake intensive propaganda from the point of view of money. They have said what always used to be said by the Government of India, *viz.*, there is such a lot of voluntary education and such a lot of demands on our educational budget that we had better not undertake an unknown liability such as compulsory education. I am very strongly of the belief that it would be advisable at any rate to bring compulsory education into a certain number of areas if it is only to prevent the terrible amount of illiteracy.

1033. Is it the District Board with whom the final decision lies?—Yes, District Boards have to vote the money.

1034. You direct your propaganda to the public?—Yes.

1035. Is public opinion faithfully reflected in the vote of the District Board?—I do not think the District Board would be averse to introducing compulsory education as long as the financial liability is not too great.

1036. I think you do agree that improved communications have an important bearing on education?—Yes, very important.

1037. Can you tell the Commission whether the Universities are entirely autonomous?—They are in a very curious position here. I do not think there is any parallel anywhere else. They are not completely autonomous. Most of the Universities in India are provincial Universities, that is to say, Government started them and incorporated them by law, Government financed them and the only other source of revenue they had was fees. Gradually the fees became so large that many of them have independent sources of income: But Government has a good deal of power over them, because they nominate a certain number of their members, they used to be called Fellows. Some of the members of these bodies are *ex-officio* members; and in nearly all cases the regulations have ultimately to be confirmed by Government or some person in authority.

1038. I think we must just have on the notes that you handed in an estimate of the difference between the cost per boy per annum in an agricultural middle school, such as in Bombay, for instance, and in a middle school in the Punjab. The information you have given us is that in the Bombay type it costs Rs. 371 per annum and in the middle school in the Punjab the estimate is Rs. 31. Is that correct?—That is quite correct. That includes every expenditure. I did not take Government expenditure only. It includes fees and what they call other sources; that is the total expenditure per boy.

The Chairman: Do you wish to ask anything on this, Mr. Kamat? It was really on a question of yours that it was raised.

1039. *Mr. Kamat:* In the Bombay type I think the pupils are allowed a stipend?—Yes, they are allowed a stipend and are provided with board and lodging free.

1040. They are provided with free boarding and lodging because they are especially vocational schools?—Yes.

1041. In the Punjab I do not think they are allowed any stipend?—No.

1042. That makes all the difference?—Not all the difference. The cost of boarding and lodging for a boy ordinarily is about Rs. 25 a month.

1043. *Sir Thomas Middleton:* Have there been any studies made in India of what might be called lapses into illiteracy, that is to say, of boys who have been at school and who are afterwards discovered to have forgotten all that they learnt?—None at all. In fact the whole question of lapsing into illiteracy has only been taken up and considered by the Government of India in recent years after the last Census Report in 1921. But there has been nothing statistical done about it.

1044. We can take your gross numbers of attendance at schools and form what estimates we like as to the probable number of illiterates?—Quite so.

(The witness withdrew.)

[Questions 1045—1198 relate to the evidence of Mr. W. P. Sangster, C.S.I., C.I.E., Chief Engineer, Irrigation Works, Punjab. This evidence has been transferred to the Punjab Volume of Evidence and re-numbered.]

Friday, October 15th, 1926.

SIMLA.

PRESENT :

The MARQUESS OF LINLITHGOW, D. L. (*Chairman*).

Sir HENRY STAVELEY LAWRENCE,
K.C.S.I., I.C.S.

Sir THOMAS MIDDLETON, K.B.E.,
C.B.

Rai Bahadur Sir GANGA RAM, Kt.,
C.I.E., M.V.O.

Sir JAMES MACKENNA, Kt., C.I.E.,
I.C.S.

Mr. H. CALVERT, C.I.E., I.C.S.

Raja Sri KRISHNA CHANDRA GAJAPATI
NARAYANA DEO of Parlakimedi.

Professor N. GANGULEE.

Dr. L. K. HYDER.

Mr. B. S. KAMAT.

Mr. J. A. MADAN, I.C.S.

Mr. F. W. H. SMITH.

} (*Joint Secretaries.*)

**Lieut.-Colonel J. D. GRAHAM, C.I.E., I.M.S., Public Health
Commissioner with the Government of India.**

Replies to the Questionnaire.

Owing to my recent return from deputation in England I have not been able to give this note the time or attention which it deserves or requires.

QUESTION 25.—WELFARE OF RURAL POPULATION.—To any one conversant with rural conditions in India the close inter-relationship between health and agriculture does not require elaboration. For the past two years at the Annual Medical Research Workers' Conference in Calcutta a resolution has been passed, a copy of which is attached as Appendix III for the information of the Commission. It called attention to the vast wastage of life and energy resulting from preventible disease and recommended the formation of a Commission to enquire into this wastage. It was realised, however, that the Royal Commission on Agriculture might cover part of the same ground as the Commission asked for, as it was expected that this Commission would find preventible disease to be one of the most important factors in the causation of poverty and that an enquiry into the condition of the agriculturist must necessarily take cognisance of the public health aspect of his life.

Any discussion on the welfare of the rural population falls naturally under several main headings. These are:—

- I. The influence of disease.
- II. The influence of nutrition.
- III. The rôle played by crop cultivation.
- IV. The rôle played by research.
- V. The rôle played by education.

The general effect of disease, and especially of such diseases as malaria, which reduce the vitality and efficiency, both physical and mental, of the ryot, must be felt in agriculture, as must also be the lowered physique and mentality due to nutritional influences which are so closely bound up with crop cultivation. The close connection between research and agriculture is exemplified by the food value of crops from a deficiency disease point of view, by the connection between rice cultivation, irrigation and malaria, by tuberculosis and anthrax in cattle, by grain storage in its relation to plague, etc. Agriculture affects diet, which if deficient or badly balanced will produce disease, whilst disease begets inefficiency, mental apathy and loss of virility. Much

of this, which affects medical research intimately, is new ground awaiting investigation.

I. Disease.—Most public health officials have in their recent reports laboured to bring home to the public the physical and economic effects of disease as it is seen in India.

Such major diseases as malaria, plague, cholera, dysentery, tuberculosis and in some areas *kala-azar*, relapsing fever, filariasis, hookworm disease and deficiency diseases, together with such so-called minor diseases as eye diseases, skin diseases and leprosy bulk largely in maiming the community and in accentuating conditions of depression and poverty. In the immediate past our attention has been largely directed towards making local or general geographical surveys of these diseases, and we have now reached a point where our information regarding many of them is considerable while that regarding others is increasing daily.

From time to time India is swept by colossal epidemics which have no parallel in any other country except perhaps China. Apart from the enormous mortality produced by these there is an appalling morbidity and maiming of the community which must have its effect on its labour productivity. It may be asked what is being done to stem the tide of such visitations. Perhaps Government of India has not received its share of credit for the work that has been done during the last eighty years in medical education and medical relief; but Government does not advertise. It is doubtful whether any Government in the world could show a better record of State aid for the promotion of these subjects. In the matter of public health, however, we are at once up against the rooted prejudices of a highly conservative congeries of peoples in whom, in many instances, religious practices enter largely into domestic affairs, specially in regard to illness and nutrition. It will therefore be readily understood why the deliberate policy of Government in public health matters should have been to lead rather than to compel, and to propagand with a view to creating in time a public health conscience. It is well at this stage to recognise that such a conscience has not yet developed, though signs are not wanting of glimmerings of it in the larger cities. I mention this in order to convey a proper appreciation of some of our difficulties both in regard to immediate measures and to proposals for the future. Again and again our workers have felt that apathy towards and want of enthusiasm in putting into practice much that has been scientifically proved as preventive of the onset of disease. As the trained medical *personnel* necessary to leaven the rural population with modern hygienic ideas can only be created with much expenditure, it has been the aim of the Government of India to provide the basic structure on which this organisation can rest and develop. Whether under devolution the general plan will develop on the lines anticipated remains to be seen; but, if so, we must expect to see different Provinces developing with different degrees of rapidity.

With a general death rate in 1923 of 25 per mille and an infantile rate of 176, over 6 million people died (England and Wales 11·6 per mille and 69 respectively). Comparatively recent actuarial tables show that the expectation of life at 5 is 35 years and at 20 is 27 years as against about 54 and 41 respectively in Great Britain, or to put it in another way, that of 1,000 persons born in England 530 reach 50 years while in India only 186 do. In other words disease has reduced expectation of life in India to less than half of what it is in countries like Great Britain.

In 1923 the deaths recorded were divisible as follows:—

Cholera	.	.	.	.	.	.	.	73,002
Smallpox	.	.	.	.	.	.	.	44,084
Plague	.	.	.	.	.	.	.	229,149
Fevers	.	.	.	.	.	.	.	3,706,298
Dysentery and diarrhoea	.	.	.	.	.	.	.	186,458
Respiratory diseases	.	.	.	.	.	.	.	297,365
All other causes	.	.	.	.	.	.	.	1,500,575

6,036,931

The application of an arbitrary correction figure of $\frac{1}{4}$ for fever mortality figures still shows over a million deaths from malaria, the morbidity of which is very great. As we have a record of nearly 8 million people being treated for it at our dispensaries and hospitals, we can surmise how appalling is the maiming due to it. Further its relation to agriculture is very close through methods of cultivation and canal irrigation which may lead to final depopulation. It is of primary importance in opening up jungle tracts to tea, coffee and rubber, whilst its connection with rice cultivation is a very complex one which occupied the attention of the recent International Malarial Conference at Rome. * Christophers in estimating the morbidity says that for one million deaths in adult males between 15-50 years of age there should be at least 2 millions constantly sick and the equivalent of 50 million admissions to hospitals.

The 1908 epidemic of malaria in the Punjab passed like a cyclone over 20 million people and resulted in a quarter of a million deaths in three months. The great epidemic of influenza which swept round the world in 1918 affected the whole of India between June 1918 and June 1919. It was estimated that over 7,000,000 deaths occurred from it in 1918, and over 400,000 in 1919. How this affected agriculture can easily be imagined. Similar epidemics of malaria, of cholera and of relapsing fever have occurred from time to time, whilst plague has been epidemic for the last 30 years.

Plague was introduced to India from Hong Kong about March 1896 and still continues its ravages. During the 20 years period 1898 to 1918 in a population of over 304 millions (average of 1901 and 1911 census) it caused over 1,000,000 deaths, the mortality per mille of population being greatest in the Punjab and Bombay (122.27 and 87.35, respectively) and least in Burma, Madras and Bengal (8.03, 3.45 and 1.49, respectively). It affects agriculture by its high adult mortality which disorganises labour and domestic economy. Its connection with the rat and with grain brings it into still closer relations with agriculture.

Cholera is now essentially a rural disease and is endemic in certain areas as are also *kala-azar* and hookworm. In regard to the last Clayton Lane furnishes us with extraordinary figures for India. He says that a conservative estimate shows probably 45 millions of wage earners infected who, at an average annual wage rate of Rs. 100 each man, would earn Rs. 4,50,00,00,000; but our tea garden experts reckon on a 10, 25 or 50 per cent increase in labour efficiency under hookworm control. This gives us a minimum increase of Rs. 45,00,00,000 or £30,000,000. Lane thinks that what has been done in Darjeeling can be done for India. In the case of cholera and hookworm prevention of soil pollution, by or with the provision of a pure water-supply, must be a sound investment, and, if to this we add anti-malarial measures, the investment becomes sounder still.

Famines and epidemics reduce fertility and produce a temporary fall in the birth rate but this is usually rapidly recovered from, though provincial investigations show that such a recovery does not take place equally or even in all Provinces and that there are instances where population has actually decreased.

With such facts before us we are now in a position to form a clearer estimate of the economic and financial effects of disease on the country. Excessive death rate, decrease in population, and excessive morbidity all contribute to interference with the agricultural development and vocations on which the welfare of the country population depends. In their train must follow loss of revenue, scarcity of money, loss of producing power, physical deterioration, in fact the establishment of a vicious circle.

In a country like England and Wales with its vast State resources for national insurance against sickness and invalidity, it was estimated that during the year 1923 there was lost to the nation, among the insured population only, and excluding the loss due to sickness for which sickness or dis-

* Presidential address, 11th Indian Science Congress (Medical Research Section).

ablement benefit was not payable, the equivalent of the work of 394,230 persons or 20½ million weeks' work. Maynard calculated that the economic loss in the Transvaal from preventible disease amounted to £2,600,000 per annum. It is almost impossible to realise what the loss must mean in a country like India; but we may rest assured that the productivity of the country will be enormously increased by an effective control of such causes as have been enumerated.

II. Nutrition (Diet).—The relationship between diet and disease has only within recent times even in Europe and America received the attention that it merits. The development of biochemical work, and the inauguration of nutritional researches, owing to the necessities of the Great War, have given an impetus to this study which is already resulting in a great increase of our knowledge and in the shattering of many time-honoured beliefs.

At the recent meeting of the British Medical Association at Nottingham in July 1926 in the section of public health a discussion took place on food deficiency conditions in relation to preventible illness (*vide* British Medical Journal, July 31, 1926, page 185), and four very instructive papers were delivered dealing with the scientific, the clinical, the tropical medicine and the public health points of view. The British Medical Association lecture was delivered by Mellanby of Sheffield on Diet and Disease with special reference to the teeth, lungs and pre-natal feeding (*vide* British Medical Journal, March 20, 1926). I would further call attention to two important and very recent papers published under the auspices of the Medical Research Council, details of which I have given in Appendix I. These all point to the importance with which this subject in Great Britain is now being regarded.

In India these studies are in their infancy. From time to time odd workers have made a special study of Indian dietaries and of their effects on health, and in this connection the work of McCay and of McCarrison must claim our attention. McCay's work, which was done over 15 years ago is recorded in our Scientific Memoirs (Nos. 37 and 48). It dealt with an investigation into the jail dietaries of Bengal and the United Provinces, and incidentally with the influence of dietary on the physical development and well-being of the people. Though McCay's work is very convincing some specialists such as the Danish expert Hindhede refuse to accept many of his deductions. McCay explains that his aim was to determine experimentally the nutritive values of the diets at present in use in the Bengal and the United Provinces jails and to work out interchangeable diets. He states that from the facts he assembled with regard to the inhabitants of the United Provinces and the martial races of the plains there would appear to be abundant evidence that, other things being equal, diet is the all important factor in determining the degree of physical development and general well-being of the people, and that, with a low level of nitrogenous interchange, deficient stamina, morally and physically, must be expected. With very precise data he concluded that the general lack of physique and vigour in Bengal is most probably due to deficiency of protein in the diet; whilst the inclusion in the diet of wheat in gradually increasing proportions as we pass up through Bihar and Orissa and the United Provinces to the Punjab coincides with our gradual introduction into the areas inhabited by the martial races. He shows that with a full rice diet such as that of the Bengali, insufficient protein is ingested, this being made up by the use of pulses; but, owing to the bulk of the diet, only about 50 per cent of the protein can be absorbed as against 90 per cent. in European diets and this even if the quantity of pulses be increased beyond the jail dietaries' allowance of 6 ounces. With the addition of wheat, however, protein assimilation is increased, thus indicating the value of a well-balanced diet of rice, *dals* and wheat which is further improved by the addition of small quantities of meat and fish. Protein deficiency is perhaps the most characteristic feature of Indian diets even though they may be generous. The Bengalee diet has a very low protein metabolism, less than half of the home standards, whilst the highest is encountered in certain hill peoples who eat rich meat dietary such as Bhutias and Nepalese. A rough indication would seem to be that the food of the population of India and the agriculture

producing this are modelled closely, in so far as concerns quantity, on the actual dietetic needs of the population.

In a recent essay* on the relationship of diet to the physical efficiency of Indian races McCarrison calls attention to the great differences in Physical efficiency of the Indian races and the contrast between those of the North, and those of the South and East. His argument is that as rice, wheat, barley, millet, maize, vegetables and fruit represent most of the food eaten throughout the country, and as milk, eggs and meat are not eaten to any extent by the masses, the diet is deficient in at least three factors:—

- (a) it contains relatively poor quality protein,
- (b) it contains too little of certain mineral elements such as calcium, sodium and chlorine,
- (c) it is deficient in fat soluble vitamin A.

He argues further that the consumption of such supplementary foods as meat, milk and its products, fruit and leafy vegetables is the determining factor in the variations of physical efficiency, and he quotes the Sikhs, the Pathans and the people of Hunza to exemplify this. In the same way as physique is affected so also are disease and immunity to disease. McCarrison is still continuing his researches at Ooonoor and has put in a special note to the Commission. In the same publication Hallilay, dealing specially with the Punjab, and quoting his experience of over 22 years as a Surgeon there, comments on the *chapati* and *dal* diet, with abundance of raw fruit, and meat only as a luxury, as being associated with freedom from certain intestinal surgical diseases, stone and cancer.

Little recent work has been done on dietaries in the Physiological Laboratories of the Medical Colleges of Lahore, Calcutta, Lucknow, Madras and Bombay. I have added a note on it as Appendix V.

In so far as concerns the mental effect of a monotonous diet I quote Professor Starling regarding Germany during the War. "Three years on a diet insufficient as to quantity and quality, indigestible, tasteless and monotonous had a marked influence on the vitality and efficiency of the great bulk of the urban population, which finally resulted in the changed mentality which rendered impossible any further efforts of attack or even of resistance. In the condition of dull apathy and mental prostration resulting from the deprivation of food the course of the War no longer seemed of importance. Food filled their thoughts by day and their dreams by night, and the only desire was to end the War by any possible means that might lead to a slackening of the blockade and the free entry of food into the country. No means could have been more effective in breaking the spirit of a nation by effects which were likely to last for some time." This is not without its lesson in regard to the influence of badly-balanced and monotonous diets on a population in peace times.

I have added in Appendix II a note by Lieutenant-Colonel Christophers, Director of the Central Research Institute, Kasauli, regarding the composition of dietary as shown by cropped areas. His calculations which are from the Imperial Gazetteer figures have been rapidly done and must be considered as only very approximate; but the results are interesting and suggest that further useful results might be obtained by more accurate estimates made on such a plan.

Undoubtedly the necessity for bulky carbohydrate meals in the absence of a high protein diet all makes for multiplication of digestive troubles and for such diseases as diabetes, these disorders appearing much less frequently as one passes northwards. The basic cereal diet of the north-west and of the Punjab, e.g., that of the Sikhs, which includes meat perhaps three or four times in a month, would seem to be a well-balanced diet making for physical efficiency. The influence of so-called dangerous pulses such as *Lathyrus*

* Practitioner, January 1925, Vol. 114, No. 1.

sativus has been blamed by McCay for illness; but our recent investigations* under the Indian Research Fund Association where we were able to arrange for the co-operation of a botanist, of a chemist, and of a doctor on the enquiry seem to point to an opposite conclusion. Hindhede challenges McCay's conclusions in regard to the need for more protein, he himself being an ardent vegetarian.

Under normal conditions the diet of an indigenous population is largely influenced by the crops which are raised in the area in which they live, and so long as the agriculture of an area is diversified the diet is likely to be diversified and competent. If agriculture is one-sided the diet tends to be unbalanced. Transportation, shortage and marketing all help to diversify the diet and represent an insurance against deficiency disease. The conditions producing dietetic deficiency diseases need not therefore obtain to any extent in normal times in India in so far as scurvy, rickets and beriberi are concerned as the three vitamins supposed to be concerned in the production of these diseases are usually supplied. Whether the absence of the water soluble B. vitamin (*i.e.*, the anti-neuritic or anti-beriberi factor) is the cause of this disease is now open to serious question in view of the recent work being done on the fungoid changes in rice as a result of imperfect storage. On this we may reserve our opinion; but, in so far as the anti-scorbutic and anti-rachitic factors are concerned, we are on strong ground; these diseases, generally speaking, in non-famine times are largely absent. The partiality of the lower orders towards eating quantities of raw vegetables and fruit would ordinarily prevent this.

The economic side of the labour wage in so far as it affects malaria has been worked out in a very interesting way in regard to the sea gardens in the Duars by Christophers and Bentley in a report† now fifteen years old which deals, *inter alia*, with the questions of food, housing, social conditions and standards of comfort of labour in this intensely malarious area.

III. Crop Cultivation.—My own experiences in 1909-10 in an enquiry instigated by a former Lieutenant-Governor of the United Provinces (Sir John Hewett) and undertaken by the late Major Robertson and myself in the Government Estate in the United Provinces, Terai, with a view to determining the conditions influencing depopulation led to certain interesting conclusions. We demonstrated that, under conditions when cultivation was easy and food of all kinds plentiful, but when malaria was present in malignant form, depopulation, from diminished fertility and huge infantile mortality, led to the necessity of constant immigration from the plains to replace the losses. Though there were degrees of relative immunity in the different aboriginal tribes the domestic fate of the plains immigrants was deplorable and only a very few of the second generation survived to adult age.

This leads up to a consideration of the influence of irrigation on health. The story is a sad one but points a lesson. Our earliest canalisation schemes took little cognisance of drainage and, as a result, the subsoil water level rose and land which had been cultivated became water-logged, soured, incrustated with alkali, and eventually passed into jungle. Meantime the conditions for the perpetuation of malaria were established and these in time led, not only to a heavy morbidity of the ryot and his inability to cultivate, but eventually to the other evils usually associated with endemic malaria, *i.e.*, to want of fertility and to depopulation. This can be seen in certain areas of the western Jumna canal, more especially in the Karnal area, and so striking was the chain of events even so far back as 80 years ago that a special Committee‡ was then formed and traversed this canal to investigate the conditions obtaining. This Committee incidentally discovered and described the spleen test for malaria, a discovery which had apparently remained forgotten until within the last 30 years.

* Enquiry by Major Anderson, Dr. Simonsen and Mr. Howard under the Indian Research Fund Association and still in progress.

† Malaria in the Duars by Christophers and Bentley, 1911, page 51, Chapter VI.

‡ The Dempster Committee. (Baker, Dempster and Yule).

In our developmental projects in the new canal colonies and wherever irrigation is being introduced the necessity for expert public health advice hardly requires to be laboured at this stage, and I believe that our irrigation engineers are fully alive to the need for drainage projects going hand in hand with those for irrigation. The conditions in some parts of lower Egypt and more recently in certain areas of Iraq should serve as a warning if this were needed. The correct use of irrigation water still requires much study. It is not, as so many people think, simply a method of supplying the rainfall shortage. Mr. Howard in a recent address* remarked on the deterioration of cultivation under irrigation, the loss of producing power of the soil, the appearance of "alkali" land and the tendency to malaria, and he adduced instances where the process had gone wrong and canalisation had produced "alkali" soil. It has long been known that dried crops under irrigation are liable to cause intense malaria and the reasons annexed require further study as do also many of our malarial problems in different parts of India which are bound up with irrigation. With the reorganisation of our Central Malarial Bureau we hope to be able soon to give more attention to such problems than we have been able to do since 1914. Mr. Howard fears an extension of the formation of "alkali" land in the Punjab canal colonies which might lead to depopulation. I am in accord with him in his statement that the addition of water to compensate for deficient rainfall does not lie entirely within the province of the engineer. The solution of such problems can only be accomplished by investigators of great experience capable of bringing several sciences simultaneously to bear on them.

One other point I would wish to draw attention to. I have already described the position as regards malaria, our greatest morbidity scourge in India. Intimately associated with this and with agriculture is the production of cinchona bark wherewith to prophylax the healthy, treat the sick and diminish infection risks. Several decades ago Sir David Prain, a distinguished member of my service, who was Director of the Botanical Survey of India and later of Kew Gardens, put the position frankly to the Government of India and advised that the cultivation of cinchona bark be embarked on by the Central Government on a large scale. It is not necessary to go into the history of what happened regarding the cultivation; but the fact remains that to-day, more than 30 years afterwards, the Central Government is not much further on in regard to the cultivation and control of this essential product. Opportunities have been missed which Java has seized, and the Dutch-German ring which now controls the bark and its refined products has forced up the price of quinine to a point at which its distribution to the general population on a scale commensurate with their needs is impossible. Fortunately the League of Nations has convened a committee on the subject; but the cheapening of this product in the open market or its substitution by the cheaper febrifuge on a scale sufficient for the prophylactic and therapeutic needs of India is one deserving of every attention and encouragement by the Agricultural and Forestry Departments.

IV. Research.—Organised research into the causes and prevention of disease, as well as the spread of effective sanitation, are important both to agriculture and to medical science. The application of research has elucidated many of the modes of transmission, and the practical application of such discoveries is being carried out in the various preventive measures that are in progress throughout the country. The future health developments of the Provinces on a scale adequate to the requirements of India must take time and cost money, but the foundations have been laid.

Medical research in India has evolved largely on medical lines, and, at present, arrangements exist for its co-ordination through the Medical Scientific Advisory Board. In the case of enquiries involving other departments such as the deficiency disease inquiry of Lieutenant-Colonel McCarrison and the lathyrism inquiry already referred to, such co-ordination as was possible has been attempted by the Secretary of the Scientific Advisory Board (myself)

* 12th Indian Science Congress, 1925. Presidential address:

in correspondence with the Agricultural Adviser and others. This is all right so far as it goes; but it is insufficient.

The deeper we probe into this study the more we are compelled to admit the necessity not only for further research work but for its organisation and co-ordination on a scale commensurate with its importance. So far our essays into this region have been largely by individual workers; but team work in which doctors, agriculturists, chemists, botanists and others are co-ordinated will be essential in India in the future if this study is to be carried out as it ought to be. The Japanese with their usual foresight and push have arranged for this study by the establishment of a Nutritional Institute under their Home Department, particulars of which will be found in Appendix IV.

We must visualise a more scientific and representative control than that which now exists. The ultimate control at the moment is essentially a financial one, more often than not exercised without any reference to the merits, demerits or necessities of the particular schemes under consideration. The recent Inchcape retrenchment of the medical research grant and its gradual restoration illustrate my point as it is only now that the Medical Research Department is returning to the financial position which it had in 1920-21. If research problems in all departments of research are to be properly presented to the Legislative Assembly which has the money voting power, one question for consideration is the need for a representative central scientific board with direct representation on the Assembly. The organisation of the Medical Research Council in Great Britain has no counterpart in this country, but there is no reason why something similar on a smaller scale should not be attempted for India. The material exists for the formation of sub-committees on many of the problems that require attack, and, in my opinion, for the constitution also of a thoroughly representative Research Council. It is only thus that we can hope to have that co-ordination of effort which is so essential for economy in research, for guidance in priority of work, and for pressing claims for the necessary financial grants.

V. Educational propaganda.—Propaganda work in connection with health has come very much to the front within the last decade. Health Publicity Bureaux are being established in all countries, and a serious and systematic attempt is being made to bring the great principles of hygiene and the cardinal facts in connection with disease prevention to the intellectual level of the great masses of the population. The development of preventive medicine in Western countries has allowed of this being done in regard to a large number of diseases, more especially the slow infectious diseases like tuberculosis and the social diseases. Though India has not progressed so far on this road as have European countries she is now making a serious attempt to do so through the Education Department, the Provincial Health Publicity Bureaux, Voluntary Agencies, Co-operative Anti-malarial Societies, Child Welfare and Maternity Leagues, Baby Weeks, Red Cross, etc. How far it is possible to utilise the Education Department still more for this purpose is a question requiring further investigation; but those of us who know India believe that is one of the surest methods of awakening the so-called public health conscience. In matters concerning the inter-relationship of health and agriculture, co-ordination for propaganda purposes is equally essential. It is, therefore, with pleasure that we see the recent development of the agricultural film to take its place with the health film. The organiser of any future plans or proposals for this activity should attempt to co-ordinate medical, public health, medical and agricultural research, and the educational departments in this connection.

The cry used to be "Does hygiene pay," but it is now "Why does hygiene pay?" Most will agree with this proposition but there is still much indifference. In a recent address Dr. Andrew Balfour says that colonies sapped by malaria, hookworm, typhoid and dysentery and who refuse to bestir themselves must go to the wall. He adds that we have only to look at Central America, Federated Malay States and Java to see the economical aspects of efficient control of yellow fever and malaria, respectively. Similarly, Porto

Rico work under American direction, mosquito reduction work in Queensland, and anti-tick measures in Jamaica which added 25 per cent to cattle production all demonstrate the truth of the proposition, and at the same time all are helping towards benefiting the public health.

VI. Personnel.—In so far as public health and research are concerned good men are essential to initiate and to control such health reforms; but niggardly salaries will never attract them. Well-paid men with an active progressive but non-extravagant policy are essential if the foundations are to be truly laid where new ground is being broken. Research has no use for mediocrity and any research department filled with mediocrities ceases to remain one. Careful and severe selection of *personnel* on merits irrespective of race or proportion of race is essential. Last but not least heavy expenditure must be budgeted for; but, as has been shown above, it is a sound investment.

APPENDIX I.

Two very recent and highly instructive publications by the Medical Research Council have thrown some light on the value of diet. The first of these is "Diet for Boys during the School Age" (No. 105), the second is "Poverty, Nutrition and Growth being Studies of Child Life in cities and rural districts of Scotland" (No. 101). Briefly the former deals with the results of certain increases to a basic school diet in a school with houses accommodating 30 to 35 boys on the villa system and over a period of four years. By varying the diet for different groups for periods over 1 to 3 years by adding fresh milk or castor sugar or butter or vegetable margarine or edible casein or water-cress definite varying improvements in weight and height increments were able to be recorded.

In the latter case the low weight and height of slum children were investigated and many prevalent ideas were upset. The chief points noted were that after 18 months the growth curves for urban and rural children run fairly parallel, that small parents beget small children, that there is no clear indication of nutrition of the child being directly associated with the income of the family, that there was a failure to establish correlation with overcrowding, that a family diet of 2,500—2,700 calories per day shows as little growth retardation as does that of 3,000 for country children, that correlation between breast and artificial feeding and child weight though manifest below 8 or 9 months is absent after that, and that maternal health is not revealed as a factor of prime importance. To summarise, this pioneer work which is the first extensive attempt to estimate the influence of various environmental conditions on growth and nutrition of slum children, shows that heredity and inherited growth play a large part in determining the child's growth which proceeds like that of its parents despite prejudicial environmental factors. Again material efficiency is more closely associated with child variations than are poverty, underfeeding or overcrowding. It has *not* been shown that a plentiful income is followed by improved condition of the children. The slum problem is therefore more complex than we think. We must, therefore, seek a middle position between these who look on plenty of money as the solution and the eugénist on the other.

APPENDIX II.

**Note by Lieutenant-Colonel S. R. Christophers, C.I.E., O.B.E.,
F.R.S., I.M.S., Director, Central Research Institute, Kasauli,
on the composition of dietary as shown by cropped
areas and calculation of diet from food
crop areas.**

It is of interest to see what the diet of Indian populations appears to be (as regards its cereal basis) when estimated on crop area, yield per acre and population.

The general nature of the diet in different parts of India so far as cereal basis is concerned is clearly shown by the amount of different crops grown. The following statement taken from the Imperial Gazetteer of areas in square miles of rice, wheat, millets, etc., is given in Table A.

In Table B this is given as the calculated amount per person of different food grains per diem. The calculation is made on figures for 1903-04 in the Imperial Gazetteer and must be considered only as very approximate. The results given by the method are, however, interesting and suggest that useful results might be obtained by more accurate estimates made on such a plan. The way in which the figures have been arrived at is shown in Table F.

TABLE A.

Area.	AREA UNDER CULTIVATION IN SQUARE MILES.			
	Rice.	Wheat.	Millet.	Gram.
Punjab	1,100	13,600	11,000	3,100
United Provinces	11,050	12,200	9,000	8,800
Central Provinces	7,000	5,300	8,000	1,500
Bombay	4,000	3,400	20,000	5,000
Bengal	54,690	2,300	12,413	...
Madras	13,000	...	25,000	...
Burma	14,542	...	2,500	...

TABLE B.

Estimated consumption of cereals and pulses in various parts of India per adult person per diem in ounces.

Area.	Rice.	Wheat.	Millet.	Gram.	Other.	TOTAL.
Punjab	1·3	11·7	4·2	2·7	5·8	25·7
United Provinces	7·7	8·0	3·5	5·4	8·5	33·1
Central Provinces	17·4	6·1	9·3	1·9	4·6	39·3
Bombay	6·7	3·7	13·4	5·4	1·6	30·8
Bengal	25·9	1·1	...	·3	3·0	30·3
Madras	10·9	...	18·4	...	...	24·3
Burma	35·5	...	4·0	...	...	39·5
India	11·7	3·0	4·6	1·0	2·9	23·2

TABLE C.

	Punjab.	United Provinces.	Bengal.
Rice	1·3	7·7	25·9
Wheat	11·7	8·0	1·1
Gram	2·7	5·4	·3
Other cereals	10·0	12·0	3·0
TOTAL .	25·7	33·1	30·3

Taking the Punjab as the example of a wheat area, Bengal as a rice area and the United Provinces as an intermediate form of dietary we should get in ounces as a rough approximation the above figures.

TABLE D.

Indian Army ration scale is the same for all areas with the option of *atta* or rice (22 ozs. of either). The cereal basis of the ration is :—

	Oz.
Atta or rice	22
Dal	3
Potatoes	2
TOTAL .	27

TABLE E.

Examples of Jail diets are the following :—

	Lower Bengal.	Bihar.
Rice	26	16
Wheat (atta) . . . . .	...	10
Dals	6	6
TOTAL .	32	32

The jail diets are fixed at something approaching the maximum quantity of the cereal basis which is capable of being eaten.

Crop.	Total yield in lbs.		Amount per person per diem lbs.	Adult diet lbs.	Adult diet ozs.
Whole of India (population 294 million).					
Rice . .	109,000 640 1,000	69,860,000,000 exported 4,480,000,000 consumed 65,380,000,000	.61	.73	11·7
Wheat . .	36,800 640 800	18,842,000,000 exported 1,680,000,000 consumed 17,162,000,000	.16	.19	3·0
Millet . .	59,000 640 700	26,432,000,000 exported 224,000,000 consumed 26,208,000,000	.24	.29	4·6
Gram . .	15,000 640 550	5,280,000,000 exported 280,000,000 consumed 5,000,000,000	.05	.06	1·0
Other grains	51,000 640 500	16,320,000,000 exported say 16,000,000,000 consumed	.15	.18	2·9
Total cereals and pulses consumed per adult person per diem				23·2 oz.	
Punjab (population 27 million)					
Rice . .	1,100 640 1,000	704,000,000	.07	.08	1·3
Wheat . .	13,800 640 800	6,960,000,000 exported say 1,000,000,000 consumed 5,960,000,000	.61	.73	11·7
Millet . .	5,800 640 600	2,221,000,000	.22	.26	4·2
Gram . .	3,100 640 700	1,389,000,000	.14	.17	2·7
Other grains	7,800 640 600	2,995,000,000	.30	.36	5·8
Total cereals and pulses consumed per adult person per diem				25·7 oz.	

Crop.	Total yield in lbs.				Amount per person per diem lbs.	Adult diet lbs.	Adult diet ozs.
United Provinces (population 48 million).							
Rice . .	11,000	640	1,000	7,040,000,000	·40	·48	7·7
Wheat . .	12,200	640	1,000	7,808,000,000	·42	·50	8·0
	exported		say	500,000,000			
	consumed			7,308,000,000			
Milletts . .	9,000	640	560	3,225,000,000	·18	·22	3·5
Gram . .	8,500	640	900	4,896,000,000	·28	·34	5·4
Other grains	20,000	640	600	7,680,000,000	·44	·53	8·5
	Total cereals and pulses consumed per adult person per diem					33·1 oz.	
Central Provinces (population 12 million).							
Rice . .	7,000	640	1,100	4,928,000,000	1·10	1·32	21·1
	exported			100,000,000			
	consumed			4,828,000,000			
Wheat . .	5,300	640	600	2,035,000,000	·40	·48	7·7
	exported			300,000,000			
	consumed			1,735,000,000			
Milletts . .	8,000	640	500	2,560,000,000	·58	·69	11·0
Gram . .	1,500	640	550	528,000,000	·12	·14	2·2
Other grains	4,000	640	500	1,280,000,000	·29	·35	5·6
	Total cereals and pulses consumed per adult person per diem					47·6 oz.	
Bombay (population 25 million).							
Rice . .	4,000	640	1,250	3,200,000,000	·35	·42	6·7
Wheat . .	3,400	640	800	1,740,000,000	·19	·23	3·7
Milletts . .	20,000	640	500	6,400,000,000	·70	·84	13·4
Gram . .	5,000	640	800	2,560,000,000	·28	·34	5·4
Other grains	2,300	640	500	736,000,000	·08	·10	1·6
	Total cereals and pulses consumed per adult person per diem.					30·8	

Crop.	Total yield in lbs.				Amount per person per diem lbs.	Adult diet lbs.	Adult diet ozs.
Bengal (population 83 million).							
Rice . . .	42,970	640	1,200	33,000,000,000			
	11,720	640	800	6,000,000,000			
	6,300	640	1,000	4,000,000,000			
				43,000,000,000			
	exported consumed		say	2,000,000,000 41,000,000,000	1·35	1·62	25·9
Wheat . . .	2,300	640	700	1,030,000,000	·06	·07	1·1
Gram . . .	1,560	640	700	722,000,000	·02	·02	·3
Other grains	11,000	640	600	4,224,000,000	·16	·19	3·0
Total cereals and pulses consumed per adult person per diem						30·3 oz.	
Madras (population 38 million).							
Rice . . .	13,000	640	950	7,904,000,000	·57	·68	10·9
Other grains	25,000	640	600	9,600,000,000	·70	·84	13·4
Total cereals and pulses consumed per adult person per diem						24·3 oz.	
Burma (population 10·5 million).							
Rice . . .	14,500	640	1,230	11,400,000,000			
	exported		say	4,300,000,000			
	consumed			7,100,000,000	1·85	2·22	35·4
Other grains	2,500	640	500	800,000,000	·21	·25	4·0
Total cereals and pulses consumed per adult person per diem						39·5 oz.	

APPENDIX III.

Copy of a Resolution of the All-India Conference of Medical Research Workers held at Calcutta on 27th to 29th October, 1924 and on 15th to 17th December, 1925.

In 1924 proposed by Lieutenant-Colonel J. W. D. Megaw, C.I.E., I.M.S., Director, School of Tropical Medicine and Hygiene, Calcutta, and seconded by Dr. C. A. Bentley, Director of Public Health, Bengal.

In 1925 proposed by Lieutenant-Colonel J. W. D. Megaw, C.I.E., I.M.S., and seconded by Lieutenant-Colonel C. A. Gill, I.M.S., Officiating Director of Public Health, Punjab.

RESOLUTION :

That this Conference believes that the average number of deaths resulting every year from preventible disease is about five to six millions, that the average number of days lost to labour by each person in India from preventible disease is not less than a fortnight to three weeks in each year, that the percentage loss of efficiency of the average person in India from preventible malnutrition and disease is not less than twenty per cent, and that the percentage of infants born in India, who reach a wage earning age is about 50 per cent whereas it is quite possible to raise this percentage to 80 to 90 per cent.

The Conference believes that these estimates are under-statements rather than exaggerations, but, allowing for the greatest possible margin of error, it is absolutely certain that the wastage of life and efficiency which result from preventible disease costs India several hundreds of crores of rupees each year. Added to this is the great suffering which affects many millions of people every year.

This Conference believes that it is possible to prevent a great proportion of this waste at a cost which is small in comparison with the expenditure.

The recent census shows that the position in India is one of grave emergency. The Conference recognises that the problem is very complicated and involves not merely medical research, but also questions of public health, medical relief, medical education, propaganda, and social and economic considerations.

The Conference strongly urges on Government the immediate necessity for appointing a strong Commission, chiefly non-technical, for the purpose of making a thorough enquiry into the wastage of life and the economic depression in India which result from causes which are capable of being remedied.

The Conference believes that the greatest cause of poverty and financial stringency in India is loss of efficiency resulting from preventible disease and therefore considers that lack of funds far from being a reason for postponing the enquiry is a strong reason for immediate investigation of the question.

APPENDIX IV.

The Japanese Government has shown its wisdom by establishing by a special ordinance in 1920 an Imperial Government Institute for Nutrition. In doing so the Japanese were laying foundations for alterations in the national diet which appeared necessary but proof of the necessity for which was demanded, and they realised the urgent need of the study of national nutritional problems. The necessity for such a study was based on several reasons, the principal of which were:—

- (1) Biological reasons,
- (2) Reasons of social policy,
- (3) Reasons of food supply,
- (4) Reasons of physical improvement.

The staff of this Institute is said to consist of 1 Head, 7 experts, 15 assistant experts, 2 secretaries, and 10 volunteer assistants, the whole being under the control of the Ministry of Home Affairs. It is divided into four departments with 14 divisions. The departments deal with the investigation of the science of nutrition and its application together with statistics and propaganda concerning it, while the divisions represent the study of food chemistry, of metabolism, of physiology and pathology, of micrology and physics, and in respect of the application of the Applied Science, they deal with the investigation of food materials, economical nutrition, preservation and distribution, cookery, infantile nutrition, utilisation of waste products. The whole is run under the Home Department on a budget of £15,000 per annum (150,000 yen).

At the present moment enquiries are in progress on such subjects as the energy requirement of the Japanese, caloric requirement during growth, hard labour and fasting, the digestibility of various grains in various states of preparation, the chemistry of different grains, the improvement of malnutrition and many other allied problems.

Lieutenant-Colonel F. P. Mackie, O.B.E., I.M.S., the Director of the Haffkine Institute, Bombay, visited this Institute while in Japan as the delegate of the Government of India at the Far Eastern Association of Tropical Medicine in October 1925 and was more impressed by its organisation and work than by almost anything else he saw.

APPENDIX V.

Little recent work has been done on dietetics in the physiological laboratories of the Medical Colleges of Lahore, Calcutta, Lucknow, Madras and Bombay. The two former are silent except that Lahore regards the mental lethargy as due to malaria and to be treated by anti-malarial measures.

Lucknow.—Dr. Burrige (Professor of Physiology) says that a recent survey of ryot's diet gave its caloric energy as 2,400 and, allowing for 10 per cent waste, as 2,160 as against 3,500 for a British workman of 67 kilograms weight working 8 to 9 hours per day; but the latter diet would not be suited for work in the Indian sun as is that of the Indian coolie who is very much in the dietetic position that the non-fighting German population were during the War. They became dull, listless, apathetic, felt the cold badly and were relieved by the heat of summer. It is evident then that, whenever it is easily possible for heat production to outstrip heat loss, work can be more safely and economically done at the expense of fats and carbohydrates, and the low nitrogen value of Indian diets has probably been determined through this factor. It may be that the virile race develops in a particular country because its climate makes a high nitrogenous exchange possible. The Indian ryot according to European standards has a low level of nutrition which may cause fatalism but may fit him better for his actual task.

Madras dietary of three meals with 4 oz. cold rice in the morning, 8 to 10 oz. with vegetables and sometimes butter-milk at midday, and 8—10 oz. at night with oil and sometimes fish gives a diet of protein 45 grm. and carbohydrate 550 grm. which, though deficient in protein and fat, carries them on though they show little resistance to disease and recover from it slowly. (Dr. Kamath.)

Bombay dietary (Dr. Thakar) shows no dearth of essential vitamins in all races and classes. Cost of milk is prohibitive. Food adulteration in restaurants and boarding houses is heavy. The ryot is always on a diet poor in nitrogen and fat, but his open active field life saves him. The zamindar is a generous feeder. The lower menial classes on daily wages feed their families well; the worst off being the lower middle class families, especially clerks, with large families. Bulky carbohydrate meals depress the general vitality and make people lethargic.

APPENDIX VI.

Under the Devolution Rules framed under the Government of India Act the responsibility for sanitation is divided between the Central and the Provincial Governments, as shown below.

Central.

- (1) Pilgrimages beyond India.
- (2) Port quarantine and marine hospitals.
- (3) Central agencies and institutions for research.
- (4) Statistics.

Provincial.

- (5) Public health and sanitation and vital statistics, subject to legislation by the Indian legislature in respect to infectious and contagious diseases to such extent as may be declared by any act of the Indian legislature.
- (6) Pilgrimages within British India.
- (7) Registration of births and deaths subject to legislation by the Indian legislature for such classes as the Indian legislature may determine.
- (8) Industrial matters included under the following among other heads,

viz. :—

*	*	*	*	*	*
*	*	*	*	*	*

(f) Smoke nuisances; and

(g) health and housing of labour.

- (9) Adulteration of food and other articles, subject to legislation by the Indian legislature as regards import and export trade.

2. The powers of the Government of India in regard to sanitary matters in so far as they have been 'transferred' are subject to the limitations prescribed by rule 49 of the Devolution Rules. Item (1) relates mainly to the Hedjaz pilgrimage and the Government of India administer this subject because it involves relations with a foreign power and relates to their obligations under the International Sanitary Convention. The Governments of Bombay and Bengal, within whose jurisdictions the ports open to the Hedjaz pilgrim traffic are situated, make arrangements for the embarkation and disembarkation of pilgrims as agents of the Government of India.

3. As regards (2) also the Government of India are contemplating a definition of their responsibility so as to limit it only to the discharge of their obligations in respect of overseas traffic or of international requirements.

4. Item (3) relates to medical research. The Medical Research Department in India is directly under the Government of India. They determine the conditions of service of the officers including their pay, pension, promotion, leave, transfer, etc. While the postings and other changes in the Department are made by the Government of India the officers are subject to the disciplinary control of local Governments when employed in provincial laboratories, e.g., the King Institute, Guindy, Haffkine Institute, Bombay, Rangoon and Shillong Pasteur Institutes. This administrative control is the result of the peculiar constitution of the Medical Research Department and its connection with the Indian Medical Service which is a central service. Local Governments are not precluded from carrying on medical research within their own

territorial jurisdiction subject to their financial powers. In fact the salaries of the officers attached to provincial laboratories are paid by the local Governments concerned, and the Central Research Institute, Kasauli, where research of varied character and manufacture of vaccines of sera for military and civil purposes, are carried on, is the only institution directly under the Central Government. Medical research is also conducted on an extensive scale by a semi-official organisation called the Indian Research Fund Association, of which the Hon'ble Member in charge of the Department of Education, Health and Lands, is the President. A copy of the rules and regulations of the Association is attached. The inquiries and investigations instituted under the auspices of the Association are conducted mostly by officers of the Medical Research Department, whose pay and allowances are met from a grant made by the Government of India for the purpose. The Association also receives an annual subsidy of about Rs. 5 lakhs.

APPENDIX VII.

Rules and Regulations of the Indian Research Fund Association.

1. The name of the Association shall be "The Indian Research Fund Association."

2. The objects for which the Association is established are the prosecution and assistance of research, the propagation of knowledge, and experimental measures generally in connection with the causation, mode of spread, and prevention of diseases, primarily those of a communicable nature.

3. Subject to the rules governing the accounts of the Indian Research Fund Association the entire control and management of the affairs, funds, and work of the Association shall be vested in and rest with a Governing Body.

4. The Honourable Member of the Governor-General's Council in the Department of Education, Health and Lands shall be the President and the following persons, *viz.* :—

The Secretary to the Government of India, Department of Education,
Health and Lands,

The Director General, Indian Medical Service,

The Public Health Commissioner with the Government of India,

The Director, Central Research Institute, Kasauli,

The Officer in charge of the Malaria Bureau,

and others who may be appointed by the President from among members of the Association who have shown sufficient interest in the objects for which the Association is established, shall be members of the Governing Body.

5. The Governing Body shall appoint its own Secretary.

6. The members of the Association shall be of two classes, *viz.* :—(a) permanent members; (b) temporary members.

The following shall be permanent members :—

(1) The President and members of the Governing Body.

(2) Every donor of Rs. 5,000 and upwards.

The following shall be temporary members :—

(1) All members of the Working Committees hereafter mentioned, provided that they are not already permanent members of the Association.

(2) Every subscriber of Rs. 100 and upwards annually during the currency of his subscription.

7. Every member of the Association shall be entitled to attend, and take part in the annual general meeting of the Association, and to receive copies of the reports and other publications issued from time to time by the Association.

8. The Governing Body shall appoint a "Scientific Advisory Board" of whom not less than three shall be members of the Governing Body, who shall examine all proposals in connection with the scientific objects of the Association, which may be submitted to the Governing Body, and report as to their feasibility. The members of such Board shall be appointed for one year but shall be eligible for re-election. They shall have power to add to their number.

The Board shall appoint its own Secretary subject to the approval of the Governing Body.

9. The scientific objects of the Association shall be carried out with the aid of "Working Committees." Such committees shall be appointed by, and work under the direction of, the Scientific Advisory Board.

10. No scheme shall be financed by the Association, unless carried out with the sanction of the Governing Body, and approved by it, and no subscription

or donation shall be made from the funds of the Association to any object which is not approved by the Governing Body.

11. Subject to the conditions, laid down in rule 10, the funds of the Association (both capital and interest) shall be under the entire control of the Governing Body for the scientific objects of the Association and shall be applicable to the payment of current expenses and charges incidental to the execution of the duties of the Governing Body, the Scientific Advisory Board and the Working Committees.

12. The accounts of the Association shall be kept by the Deputy Accountant General, Central Revenues, in such form as the Deputy Accountant General, Central Revenues, with the approval of the Governing Body, may prescribe. An audit report together with a statement of the accounts of the Association shall be prepared by the Deputy Accountant General, Central Revenues, as soon as possible after the 1st of April in each year, and shall be submitted to the Governing Body, who shall forward it to the Government of India. An annual report of the proceedings and of all work undertaken during the year shall also be prepared by the Governing Body for the information of the Government of India and of the members of the Association.

13. The Association, through its Governing Body, may accept the management of any endowment or trust fund, or subscription, or donation, provided that they are unaccompanied by any condition inconsistent or in conflict with the nature, object, and provisions of the scheme. All property purchased with the funds of or acquired by or on behalf of the Association shall be held in the name of the President of the Governing Body.

14. A general meeting of the Association shall be held once in every year, as soon as possible after the preparation of the annual accounts and report, at such place and time as the Governing Body may appoint. Meetings of the Governing Body, the Scientific Advisory Board, and the Working Committee shall be held as often as may be necessary.

15. The Governing Body may frame such rules as may be necessary for the discharge of business generally, including the conduct of correspondence and the holding of meetings.

O al Evidence.

1199. *The Chairman:* Lieutenant-Colonel Graham, you are Public Health Commissioner with the Government of India?—I am.

1200. You have been good enough to lay before the Commission a very comprehensive statement of your views on matters of public health, for which we are greatly obliged. It has to be read, of course, in conjunction with the note on sanitation which was provided for the Commission at an earlier stage. You emphasise, in your note of evidence, the inter-relationship between health and agriculture?—I do.

1201. I do not know whether in that matter, or in any other, you would care to expand your printed words by any statement at this stage?—Not immediately. There is one point which I might mention, which has arisen since I wrote the memorandum. Colonel McCarrison, working at Coonoor, on diet deficiency disease yesterday sent me an intimation of a piece of work he had done of which I was not aware when I wrote my remarks. He has actually produced experimentally stone in the bladder by dieting rats in a particular way. That is a very interesting discovery, because he is dieting these rats on diets closely approximating to the diets we know exist in the 'stone' areas. As you are of course aware, there are certain areas in India where stone is very prevalent, and that illustrates what I was trying to bring out in my note—the close relationship of diet and disease. He has done this not once but fifteen times in all, and, if this is the commencement of an inquiry which leads us to the ultimate causes of stone in areas where we have known nothing about its causation, it will be very important indeed.

1202. Provided the inference from these experiments is correct, the effect will be to show that 'stone' is a deficiency disease?—Not necessarily a deficiency disease but a disease produced by peculiarities of diet.

1203. I want to ask you, with reference to Colonel McCarrison's work, whether he has carried his researches into the growing period and the pre-natal history of the individual. It struck me that the importance of these results might be even more significant in the case of growing children, and perhaps of pre-natal life?—I think I have emphasised the fact that in India that particular phase of the inquiry is very largely in its infancy, and I do not think Colonel McCarrison has touched that side of it particularly. I have pointed out in an appendix* how the latest researches of the Medical Research Council at Home (an abstract of two papers of which I gave as an appendix) pointed towards the enormous amount of work to be done on that particular side.

1204. Do you think that the opportunities of observing men of the same race under better conditions of nourishment afforded by the Indian Army has been taken full advantage of for the purpose of comparison and control?—I do not think the scientific side of it has been looked at at all in the Army. The practical side has been. Naturally they recruit their men from the races whom they consider the best physically and from the point of view of military service.

1205. Carefully collected observations over long periods in the Army might afford a very valuable control for these experiments, might it not?—It would. I have a document here which I received since I wrote my note. It is a life assurance experience published in the papers a few days ago; it is the experience of Indian assured lives compiled by the Oriental Government Security Life Assurance Company of Bombay. As far as I know, it is the first thing of its kind that has appeared in India during my time. The statement has been largely reprinted in most of the papers. It deals with 51,000 Indian lives, Hindus, Mahomedans, Parsis and Indian Christians and covers the Presidencies of Bombay, Bengal, Madras, the Punjab, Delhi, Sind, the United Provinces and the Central Provinces. The experience is in regard to average heights and weights of this particular insurance company, and it all goes to bear out the conclusions to which we have come in regard to the

* Appendix I, page 149.

superior physique of the peoples of northern India as distinct from those of the south and east.

1206. Do you think that superiority is due to racial characteristics or to conditions of diet and life, or both?—I think I said in my memorandum that the question is very much *sub judice* at the moment. Colonel McCay went very strongly for the absence of the protein elements in the diet as being the causation; but I showed how that had been questioned by Dr. Hindhede, a leading Danish dietetic expert, and that is one of the reasons why I say we require more inquiry in India on this particular subject.

1207. Are there available any vital statistics of Indians abroad?—I think perhaps in the colonies, in Fiji, Trinidad and some of the other colonies where Indian coolies go to, we may be able to get figures. I know there are figures but I do not know fully about them.

1208. They might be very interesting?—Yes, they might be.

1209. Do you think we can compare the vital statistics of India with those for instance of Great Britain or do you think some allowance should be made for early maturity?—Well, the first fallacy is the registration fallacy. Our registration system here is, of course, nothing like so accurate as the Home system. They are dealing with a very much smaller population at Home and they have been dealing with accurate statistics for a very much longer time than we have in India. But certain statistical phases can be compared. For instance, mortalities are fairly comparable. Causes of death are not comparable; the reason is obvious. Mortalities represent facts; causes of death are merely matters of opinion.

1210. But to go back to my question, do you think that these comparisons require any adjustments in the light of the earlier maturing of the races in India as compared with Europeans, if such is the case?—Undoubtedly.

1211. You give some very remarkable figures on page 142 of your note, in which you point out that the tea garden experts in India reckon on a 10 or 25 or even 50 per cent increase in labour efficiency under hookworm control. Now, is that control expensive?—As compared with the ultimate results of course it is not expensive. I do not think any health control, anti-malarial or anti-hookworm, is expensive, if you view it from the point of view of adding to the labour efficiency, once the control has been in operation for some time. We have a very clear instance in the rubber plantations of the Federated States, where the amount spent in certain plantations on medical relief in the period before the anti-malarial operations had been in operation for some time was very much greater than is now necessary. I think that is the general experience.

1212. How is the hookworm eliminated from the body?—By various drugs (chenopodium is the particular drug) and by systematic treatment combined with microscopic examination to control the results.

1213. And that is required in each individual case?—Yes. As a matter of fact, it is done *en masse* when you are dealing with a large labour population.

1214. So that it is an expensive treatment?—It requires money, of course.

1215. You emphasise the importance of a pure water-supply. Have you any constructive proposals in that direction?—I think Provincial Governments have got the whole question of water-supply throughout the Provinces under consideration; they have indicated very clearly the lines on which progress should go both in regard to water-supply of villages and water-supply of towns. The protection of wells, of course, in villages bulks more largely than anything else as the great objective which zamindars and others should aim at.

1216. If you could give the Indian cultivator pure water it would go a very long way towards improving his health and efficiency, would it not?—Certainly.

1217. Do you think that at the present moment the machinery exists in the Presidencies and Provinces to bring about the changes which you desire?—Well, the basic machinery is there but funds are necessary and education of opinion is necessary.

1218. Have all Provinces Public Health Departments?—They have.

1219. Now what occurs to me as an important point is on page 146. You are talking about the need for the interpretation of results obtained by specialists in various lines of research; the need for correlation and wide appreciation by a man skilled on the technical side but able also to gather the strands together and come to a general conclusion. I wanted to ask you whether there were many men of that sort about, men, as you say, of great experience and capable of bringing several sciences simultaneously to bear on the work of co-ordination. Is it very hard to find men for that work?—I do not think they exist in large numbers, but there has not been any very serious attempt to discover them.

1220. Or possibly to develop them. Do you think that some attempt might be made to develop them?—I cannot see why they should not exist.

1221. How would you go about it?—Try!

1222. Is the world price of quinine important in relation to public health in India?—Very definitely, I think.

1223. Does it place a definite limit to the amount of anti-malarial treatment that can be given?—Yes, that is so. There is no question of that. We have Provinces complaining about the cost of quinine and their inability to buy sufficient for their needs.

1224. Is India capable of growing her own quinine, of producing her own quinine?—So far as our experts have been able to inform us, India is supposed to be capable of it. We have known this for many decades now.

1225. How many years does a Cinchona tree require to come to the point of maturity where quinine can be produced?—I think it is between 8 and 10 years.

1226. You think that even now more might be done, to provide quinine grown in India?—We have had a Cinchona Committee within quite recent times, last November in fact, and the position was considered and certain recommendations were then made with regard to the increase of plantations.

1227. Is their report a published document?—There are reports by both Bengal and Madras Cinchona Factories and Plantations.

1228. I mean, by this Committee to which you have just referred?—The Proceedings of the Committee are in the Proceedings of the Education, Health and Lands Department.

1229. Do you feel that the Departments of Health in India are in sufficiently close and sympathetic touch with the Departments of Agriculture?—I can only speak for the Government of India. I personally am in fairly close touch with the Agricultural Adviser whenever it is necessary. As far as being in touch with the Provinces is concerned, I cannot state the position between the Directors of Health and the Directors of Agriculture in the Provinces.

1230. But I judge from your memorandum that you are of opinion that, if an advance is to be made, it must be made all along the line, health, education, etc.?—Yes, very definitely, so.

1231. You think that more definite steps might be taken to co-ordinate a substantial forward movement?—Yes. The difficulty at present is that we are inclined to work in water-tight compartments. I do not necessarily know anything of the policy of the Agricultural Department in regard to a great many points that I might be interested in unless I take special pains to find out, and one usually does that when one is up against a particular concrete problem on which one wants help or information. For instance, there is the inquiry in regard to lathyrism which we have going on just now. Well, we

happen to have been able to co-ordinate work in that respect by having a botanist and a chemist as well as a doctor on the inquiry. This necessitated a certain amount of correspondence with the medical people and the agricultural people and in that way we have co-ordinated. But after all, it is a very small thing. It does not affect the main lines of policy at all.

1232. Can you say from your own experience or knowledge whether in the Provinces there is this most desirable co-ordination of effort between the health services, the agricultural services and the educational services?—Since decentralisation, we are not in a position to know, as we know before.

1233. If it became apparent to you as Adviser to the Government of India in these matters that a particular Province was lagging behind the rest of India in matters that come within your purview, what steps would you take?—I should have demi-official communications with the Director of Public Health in the first instance.

1234. In the particular Province?—In the particular Province. In the second instance, I should point the fact out to the Department of Education, Health and Lands of the Government of India and suggest that the Local Government be informed. But I have no assurance that any steps would necessarily be taken.

1235. So that you think that the position of the Government of India *vis-à-vis* the Province in a matter of that sort when a Province is lagging behind would be this, that the Government of India would say "You are not doing as well as the rest of India is doing; you are not doing as well as it appears to us that you might be doing. Please do a little better"?—Yes.

1236. And of course the Government of India would leave it entirely to the Province to decide how to do better. Or in recommending an improvement, would you send down detailed suggestions as to carrying out that improvement?—At present not, unless they were asked for. I might make suggestions to the Director of Public Health; that is quite another matter: but I do not think I should put up suggestions to the Local Government direct until such time as I was asked for my opinion.

1237. That is what I thought. I see you emphasise the importance of the cinema as a means of public instruction. Do you think there is a large future before that particular method of propaganda in India?—I feel sure of it. It is a method of instruction which appeals to the uneducated very definitely and as it is a moving picture I think they understand it.

1238. The preparation of films is expensive and difficult, is it not?—It is becoming less difficult and less expensive.

1239. Do you think the preparation of films might be undertaken by the Government of India with a view to films being supplied to the Provinces for exhibition?—I should think it was a very laudable direction in which to educate the public, not only in matters of health but in matters connected with other departments as well.

1240. But if the best results are to be obtained from using this opportunity, there will have to be a definite organisation behind the movement will there not?—Yes.

1241. And there would have to be the best of skilled direction in the preparation of these films and a close touch between the organisation preparing them and the particular service towards whose affairs any particular film is being directed?—That would be necessary. At present, the Health Publicity Bureaux of the different Provinces are all trying to work out their own salvation as regards cinema film work, but, though there is quite a number of films, I do not think the total number of films in all the Provincial Publicity Bureaux in India would be important at the present moment.

1242. I want to get this matter in perspective. Do you think that the cinema as a means of public education in India offers quite exceptional opportunities for the future? Do you think it immensely promising?—In so far as public health is concerned, I think it is. But it must be combined, of course,

with other methods of instruction. It would be combined with exhibitions of various kinds in connection with what I hold to be more important than anything else, namely, the tuition of the young in matters of hygiene.

1243. Would you recommend an intensive experiment in public health education by means of cinema films in a group of villages?—I think it would be an excellent method of propaganda which we have not been able to test at the present moment to the full because of the expense entailed.

1244. And that intensive experiment would give you the opportunity of closely examining the effect of each particular film and indeed of each section of a film?—The difficulty is that we cannot expect results from this until a very considerable period has elapsed and if it is proposed to judge of the value of this by immediate results then I should say we could not look for them.

1245. I was rather thinking of testing the effect on the minds of the audience by having in the audience here and there those who would report the remarks that were made as the film is shown and who would move about in the villages after the films have been shown and do their best to come to a view as to whether the films had made a deep impression on the minds of those who had seen them. But the fact that you would have to wait a few years for the results is another reason for beginning your efforts as soon as possible, is it not?—Yes.

1246. *Dr. Hyder:* You say that disease is one of the important factors in the causation of poverty?—Yes, I think so.

1247. And do you think the Government of India or the Provincial Governments have not been able to pursue an active and forward policy in matters of public health because of the prejudices of the people, their conservatism and ignorance and things of that kind?—I do not think there is any doubt about it. The same applied to Great Britain in the early days of the public health movement. It applies to any country, but perhaps more so to India because, as I said, of the intimate way in which religious practices are bound up with the life of the people.

1248. Coming to this question of expectation of life, I suppose you are of opinion that the people of this country do not realise the great national loss which they incur when their talented persons pass away at a very early age? If you look at the life of any eminent Indian, you rarely find that he has lived to a good old age. The people of this country do not realise their great national loss as regards leadership and direction of affairs?—I should say that educated people ought to be beginning to realise it, because it has been pointed out very frequently; but the illiterate people will never realise it.

1249. With regard to the illiterate people, there is the economic loss; there is less wealth produced. With regard to those people who have the direction of national affairs, all these eminent Indians pass away at a very early age and leave the direction of affairs in immature hands. Is that your view? Or rather would you accept that view?—I would not accept that view because I have no data on which to base an acceptance.

1250. Since the period of expectation of life is shorter here as compared to that in England?—Yes, but it does not necessarily follow that your supermen amongst Indians are going to die off altogether. You must have a certain number of them living. You say the conduct of affairs is going to pass into hands of inexperienced men.

1251. I am only speaking of the average?—I would not even say that of the average, because I have no data on which to know how far this process of early demise is affecting the intelligentsia of India.

1252. You have served in the United Provinces and you are aware that hookworm prevails in the United Provinces?—It does.

1253. And it prevails largely in the eastern districts and does not prevail in the drier districts?—We do not quite know. We are making a geographi-

cal survey at the present moment and you are probably quite correct in saying that it is more prevalent in the eastern part of the United Provinces than in the western, but we could not say that it is absent from the western and at the present moment we are trying to find out more about it. You are probably correct. We are having a geographical survey all over the north of India to find out exactly how far it prevails.

1254. The report issued by the Government of the United Provinces and submitted to this Commission, says that it is practically impossible to eradicate hookworm so long as the people of this country do not put on shoes?—Well, one of the methods of entry of the infection is by the feet.

1255. And this application of night-soil to the fields has got some bearing on infection?—There is no question about it that the habits of the people are the chief cause of the infection by hookworm. Hookworm is a disease which is very largely absent from the European population.

Dr. Hyder: Because they put on shoes?

Sir Henry Lawrence: Did you say the application of night-soil?

Dr. Hyder: To the fields?—Yes.

1256. *The Chairman:* Do you mean the deliberate application of agricultural manure or the habit of relieving nature in the fields?—I meant the habit of relieving nature in the fields.

1257. *Dr. Hyder:* In answering a question put by the Chairman, you mentioned some drug. Do you think thymol a very expensive drug?—Yes, it is fairly expensive.

1258. And it is an effective drug too. So that if we could get large quantities in particular Provinces an active campaign could be carried on?—I think everything would point to chenopodium as being the drug because it can be got locally. It is a drug which is indigenous to the country and is much more likely to be useful than a synthetic drug would be.

1259. Coming to page 142 of your 'Replies to the Questionnaire' I do not quite follow these links of reasoning in your argument. You say: "Excessive death rate, decrease in population, and excessive morbidity all contribute to interference with agricultural development." Is there not also in this country an excessive birth rate? They are more or less correlated, are not they?—Do not call it an excessive death rate; call it a high birth rate.

1260. I want to ask you a question about the prevalence of high mortality in the Punjab and in Bombay, and its being less in Burma, Madras and Bengal, as regards plague. Could you assign any reason?—Various theories have been put forward. I do not think we are on sound ground yet with regard to the reason. The Plague Commission put forward some very definite reasons, but after all they are only theories.

1261. With regard to this question of diet; I wonder if you would accept this aphorism, that one is what one eats?—The question of dietetics determines a great many of the characteristics in the individual; there is no doubt about it.

1262. You say there should be a representative of the Research Council in the Assembly; your idea is that you must have a member to obtain money for you?—Those are my own personal opinions and I have given reasons for them, my chief reason being that schemes of research, it does not matter whether they are medical or connected with any other department, come up for adjudication by some one who does not know the scientific importance of them, and this suggestion I have put up is one method of allowing for the scientific importance of these schemes being brought before the Assembly.

1263. Would you like to have a representative in the Assembly so that you could enlist the sympathy of the Assembly and get more money?—Money we are always needing; nothing can be done in research without money and naturally one feels that one has to stress the pecuniary point in giving evidence before a Commission like this because there has been difficulty in the past. There is difficulty even now.

1264. With regard to this question of population generally, you have not given any attention to the cattle population? They are numerous and inefficient and similarly the human population is numerous and inefficient. So the cattle and the people in this country are on a par; it is a tragic fact. Was there ever a public health exhibition held in any town in India?—I think so, in many towns.

1265. You think the Government should encourage the plantation of cinchona trees? I believe there is a plantation of cinchona in the Nilgiris?—The Madras Government have one there.

1266. It is not a monopoly of the Central Government?—It is not of the Central Government; it is of the Provincial Government. My point is that the policy which was recommended over 40 years ago by Sir David Prain* was one of centralisation of the whole cinchona manufactory, and had that taken place at the time it was recommended, India would have been in a very different position to-day. I do not think there is any doubt whatsoever about that. The growth of cinchona bark has been relegated to two Provinces, and the Government of India, at the eleventh hour, are attempting to start plantations in Mergui in the south of Burma.

1267. In our view these indigenous systems and practice of medicine constitute one of the obstacles as regards public health?—That is a very large question and I have not got very precise views on the subject. There is no doubt that the indigenous system has in one aspect of it certain things that we may very well take advantage of. There are certain indigenous drugs which probably are very useful, and there is no particular reason why these should not be used in treatment in India; and for that reason we have arranged, both in Bombay and in Calcutta, for our pharmacological departments to test systematically the whole series of indigenous drugs as represented by the *Ayurvedic* and *Unani* systems. That is a matter of time and we are steadily casting out those which are of no use and publishing statements about those which are found to be of use. That is where the *Ayurvedic* and *Unani* systems are useful; but to claim for the *Ayurvedic* and *Unani* systems that they are going to supplant the superior scientific attainments which have come as a result of the introduction of modern medicine and surgery is to my mind quite absurd.

1268. So that this departure which has taken place in the United Provinces and also in Madras is a departure about which one cannot have definite views?—There is only one point about the departure in the United Provinces; that is, it is being put on an organised basis with registration and control of the practitioners of these particular Indian systems of medicine, and in so far as it does that it is going to be of use, because in time to come the grading up of that system of medicine will allow of large numbers of the population being treated, perhaps not as scientifically as they would be with modern medicine, but at the same time treated by local drugs which are of approved value. This is going to take time; but in so far as that side of it is concerned, the movement may be valuable.

1269. Where are these areas in India to which you were referring when you spoke about the prevalence of stone?—In the United Provinces, Moradabad, Saharanpur; yet if you go to the east end of the United Provinces you find nothing of the kind.

1270. Is that due to water?—We do not know; up to date we have not got to the proximate causes of the condition.

1271. *Sir Thomas Middleton*: Do you agree with me that one of the chief obstacles which confronts us in endeavouring to improve agriculture is the malnutrition of the men and the cattle employed on the land?—I have no doubt that malnutrition enters very largely as one of the difficulties in improving agriculture because your inefficient, disease-ridden population is

*Formerly Lieutenant-Colonel, I.M.S., Director of the Botanical Survey of India, and, on retirement, Director of Kew.

not going to apply itself to the land in the way that an efficient population would.

1272. Leaving cattle aside, and taking for the moment the human factor, to what extent are dietary studies now being conducted in India?—Ordinarily they might be conducted in the physiological laboratories and the medical schools. We know that very little work has been done on them within the last decade. It was in connection with the Physiological department at Calcutta that Colonel McCay wrote his monograph to which I have referred in my memorandum. That was fifteen years ago.

1273. So that recently there have been no, or not many, dietary studies like those referred to in your memorandum which were conducted by Professor Noel Paton in Glasgow?—The only parallel to that is the inquiry by Colonel McCarrison. Colonel McCarrison was conducting dietetic inquiries but his inquiries were closed down by the Inchcape Committee and he went home on leave. He has only come back to us on the distinct understanding that he would be allowed to resume his inquiries. He began one year ago, on the restoration of the Research grant, and he is now conducting his inquiries under the Research Fund organisation.

1274. Where is he located?—In the Pasteur Institute, Coonoor.

1275. Then you agree there is a great absence of facts in judging of the nutritional position of the Indian cultivator. We are at present without the facts?—We want more facts.

1276. Are these dietary studies costly? I put it in a general way; assuming you have a directing head, who draws up a scheme, is it a difficult thing to conduct dietary studies?—Yes, it is; it requires very expert control.

1277. But it is not a difficult matter to collect statistics of dietaries?—No, the collection is not difficult, but even there I think when you meet Colonel McCarrison you will realise how much depends on the skill of the trained assistants he has. You asked about costs. At present Colonel McCarrison's grant from the Research Fund is Rs. 66,000 odd per annum for what he is doing.

1278. I am fairly familiar with the way in which these dietary studies are conducted in Britain and other countries, and it seems to me that at a comparatively small cost there are wonderful opportunities of making dietary studies in India. In Simla here the first group I should like to see a dietary study made of would be the rickshaw coolies. Has any attempt been made to discover their requirements? Supposing we take the average calorie requirement of the population at 2,500, what are these rickshaw coolies likely to need?—Probably 3,500 or more. The Japanese rickshaw coolies want about 4,000.

1279. The point I wanted to bring out was, it is not enough to know the average requirement for the population; what one has got to get is the needs of different groups of workers in a community, and it is this kind of information which is so lacking in India?—Colonels McCarrison and McCay did a good deal of work on that and one of them actually investigated the requirements of the Bhutia coolies, who are very much like the rickshaw coolies, and various other hill races who were carrying loads in the Darjeeling area, but a great deal more is necessary and I quite agree that we probably could do it a very small cost comparatively.

1280. *Sir Ganga Ram*: Has the Central Government issued any leaflet to define what is rural sanitation? The reason why I ask that question is that it is in the mouth of every legislator nowadays to propose something for rural sanitation without knowing what it means or how the money is to be spent?—The Government of India have not issued anything since the general memorandum* on sanitation and public health.

*Resolution by the Government of India, Department of Education, Nos. 888-908, dated 23rd May, 1914 "Indian Sanitary Policy 1914."

1281. I mean on rural sanitation?—That included rural sanitation, though it was not rural sanitation *per se*, but a general memorandum on the subject. That was about 1914.

1282. Do you not think rural sanitation has peculiarities of its own, apart from those which affect the urban population?—The Government of India is no longer issuing general statements like that in view of the transfer. These are coming from the Directors of Public Health of each Province.

1283. Can cinchona be produced in all Provinces?—I think there is a very definite limit to the area in which cinchona can be cultivated. That has been pointed out in the botanical survey, and we know the areas where it can be cultivated.

1284. Can it be produced in the Punjab?—I do not think so; it might grow but it would not be a commercial proposition.

1285. We know very well that for malaria the specific is quinine, but have you not found out any other indigenous herb for it?—We know that in indigenous systems various local drugs are used: *Neem*, for instance, has been used, but none of these have the same physiological effect on the individual as quinine.

1286. May I ask if sufficient research has been made into these herbs in the Himalayan forests?—We are not making researches broadcast, but we are taking up the actual herbs for which claims have been made by the Indian systems.

1287. Think of the enormous numbers of herbs which have medicinal value in these Himalayas?—It is for that reason that we have created the two pharmacological sections at the Haffkine Institute in Bombay and the Tropical Institute at Calcutta.

1288. Do you not think that rice, when eaten with fish, will contain all the requirements of nutrition, but when it is eaten only with pulses, it has not got sufficient nutrition to keep the body in good health?—What I have shown in the memorandum points out that a full rice diet with a little pulse added to it is an inferior diet. If you add fish to it, it stands to reason that you are improving your dietary and making a better balanced diet.

1289. On page 141 you say that the Government of India have aimed at providing the basic structure on which the organisation can rest and develop. May I ask you for a little explanation of that? What organisation do you want?—Take the organisation of the Punjab Health Department for example, with its Director of Public Health, its four Assistant Directors of Public Health and its system of District Health Officers.

1290. Does not that exist in other Provinces?—It is coming into existence in other Provinces, but I think the Punjab is the best organised in that way, with the exception of the United Provinces.

1291. Do you not think stagnation of water in the borrow pits of the railways on the banks of the canals is conducive to malaria?—It all depends on the vicinity of human habitations. I would not condemn the borrow pits of railways universally.

1292. Do you not think the wheat-eating population can resist many diseases much more than the rice-eating population?—I have shown so in the memorandum.

1293. I mean generally for all diseases?—The physique of the wheat-eating races, generally speaking, from the resistance point of view, is better.

1294. We know that in Bengal there is a large consumption of oils, not only in food but for rubbing the body. If the oil cultivation is stimulated do you not think it would to a certain extent fill the deficiency of protein?—No, it will not; oil is not a substitute for protein.

1295. Would you advocate that hygiene should be one of the subjects taught in all schools?—Undoubtedly.

1296. Are there any easy text books which can be introduced?—Primers have been written, but I do not know how far they are in use at the present moment in the different Provinces.

1297. About the introduction of the cinema for educating the populace; do you not think the Government should co-operate more largely with the Red Cross movement? They have taken up that method of educating the people?—I think at the present moment the Red Cross is very intimately in touch with the provincial health organisations. In fact the Red Cross has been the medium of the publication of a large number of pamphlets for them.

1298. Do you not think the Government should more liberally co-operate with them in this matter instead of having a separate department of its own for that purpose?—Well, I should not be prepared to go so far by any means as to say they should abolish all the publicity bureaux, because I think they are performing very useful functions.

1299. *Sir Henry Lawrence*: Can you tell us, has there been any change in the diet of the people on a large scale in the last 30 years or so?—I could not say. It is extremely unlikely, I should say. Knowing the peculiar way in which the dietary of particular areas has had a definite relationship to the productivity of those areas and the particular nature of the crops produced, I should say it is extremely unlikely that any change has taken place.

1300. Can you explain in what way the productivity of the different areas has varied with some change in diet?—In an area like the Bengal, for instance, where their production is very largely rice, rice has entered into the diet of the population in a way that it has never done up-country where wheat has been produced in very much larger quantities.

1301. And is the efficiency of the population greater in Bengal than elsewhere?—Generally speaking, we should argue I think that the efficiency of the up-country population was greater than the efficiency of the Bengal population.

1302. You connect that with the consumption of wheat?—It has been connected. I am not prepared to dogmatise on it because, as I have said, there are different points of view in regard to this. I think more work is necessary.

1303. Have you any indication that there has been increased consumption of wheat in the country?—I have no definite figures with me.

1304. Or have you any information whether any particular classes of the population have changed their diet from millet to wheat?—No.

1305. That has been alleged in the West and the Punjab and Sind?—I know it has been, but I have no figures to show whether it is so or not.

1306. If it did take place it would be to the good?—Yes, at least as far as our present ideas go on the subject.

1307. You spoke of hookworm. Has there been any investigation of the geographical distribution of hookworm among the jail population?—Yes, there has been for many years now, more especially in Burma, the Central Provinces and Madras where the jail population has been very carefully examined for hookworm and we have very definite figures in regard to hookworm infection.

1308. Can you tell me anything about hookworm in the Bombay Presidency?—Hookworm has not been investigated so carefully in Bombay as, for instance, in Madras. There are reasons for that. Initially in Madras the disease declared itself very definitely and the Rockefeller Board of New York came in to assist the investigation and it was owing to the help and the impetus given by the Rockefeller Institution that the inquiry which went on for several years in Madras took place at all, and in the systematic way in which it was organised. Madras really represents the most carefully organised investigation that we have had into hookworm in any of the Provinces.

1309. Is that because hookworm is more prevalent in Madras than elsewhere?—It was supposed to be initially, and the facts seem to bear out that it probably is.

1310. Is there very little hookworm in the Bombay Presidency?—We consider there is less than in Madras, but there again we are up against want of information, and when we have this geographical survey that we are doing now completed, we shall be better able to tell.

1311. Can that survey be effectively made by taking the jail population as a faithful microcosm of the whole population?—No; in making a survey we should deal with the general population in the villages.

1312. And you can get no correct indication in a short space of time from a concentrated investigation in the jails?—You can get facts which you can apply; but you may go very far wrong in applying these facts because there may be sections of the population where there may be very little hookworm for all we know. Of course you have a mixed sample in a jail; that is your point, I take it, that you ought to be able to argue from the mixed sample to the general population. There are fallacies in it I think.

1313. Could you tell us anything about the comparative expenditure of public funds on hospitals and on public health?—Off-hand I have not got figures, but there is no difficulty about getting them.

1314. Is expenditure greater on the cure of disease in public hospitals than on the prevention of disease through the public health organisations?—I should think so.

1315. To which do you attach the greater importance?—I am a hygienist and I naturally think that the future of all State work in this country is going to swing round to the prevention of disease.

1316. Do you find that your Legislative Councils and the Legislative Assembly appreciate the importance of public health and the expenditure on public health?—From what I have seen and read I believe that Provincial Governments are very sympathetic to public health if the presentation of the case is made properly.

1317. I am speaking of the attitude of the members of the Legislative Councils and Assembly?—I should say that generally speaking the Assembly is sympathetic towards public health. An educational process has been going on now for some time which I think is showing very definite signs of a better appreciation of public health problems now than, say, ten years ago.

1318. You have not noticed any tendency to attack public health or any proposals or to abolish the Public Health Department and its officers?—There have been proposals.

1319. That does not show much sympathy?—But that has come from particular quarters and taking a general perspective of the whole situation one comes to the conclusion that the opinions of those people do not represent the generality of opinion.

1320. You think there is no particular danger?—Well, it is a danger that has to be faced. If there was a general proposal to abolish the Public Health Department it would have to be fought out on its merits and that is a danger, of course, we cannot get away from.

1321. Is there any particular policy that you could recommend to enable the Public Health Department to secure a greater measure of confidence from representatives of the people? Do you think they do not at present have that confidence?—I think there has been a tendency to exploit the development of the Indian systems of medicine as being more or less antagonistic to modern public health policy. One has seen signs of it from time to time but it is very difficult to estimate what that means.

1322. Is there any teaching in the Indian systems, the *Ayurvedic* or *Unani*, in favour of public health? Are they not more concentrated on the cure of the individual?—They are more concentrated on the cure,

1323. There is no system of public health advocated in the *Unani* or *Āyur-vedic* systems?—I am not versed, except in a general way, in the principles and precepts of the two systems, but so far as I know they are mainly concerned with the cure of disease.

1324. Then you spoke of the position of the Central Government *vis-à-vis* the Local Governments now owing to decentralisation. Does the Government of India not address the Local Governments at all on matters of public health any longer?—They may address them, but I think they are not laying down any very definite policy. I have very little doubt in my own mind that it is only a matter of time till the pendulum swings back a little way and the Central Government perhaps desire to retain a little more control over certain aspects of public health than they have at present. I do not for a moment suggest that there should be a return or a non-transfer of public health. I think it is all to the good that public health should be a provincial subject. But at the same time there are certain large questions of policy in connection with public health when you are dealing with a number of States and Provinces, that is, public health from the federal point of view, which can only be dealt with by the Central Government having a very definite measure of control over certain things. In other words, the Central Government must not be afraid to lay down what they consider a fair line of policy for the whole country, which may, however, be developed by individual Provinces in any way they wish.

1325. What is the connection of your Department with the Haffkine Institute in Bombay?—The Research Department of the Government of India provides the Director and one or two Assistant Directors and also provides a certain amount of money for various researches that are going on in the Institute, and generally controls the policy of the researches.

1326. Then it is under your control?—Financially it is not under our control but under the control of the Government of Bombay. The Bacteriological Department of the Government of India provides a certain proportion of the senior officers to fill superior appointments.

1327. As regards the investigations that are being made into local indigenous drugs, that is a matter in which you can advise?—We do advise. Our general advisory control over all the institutes is fairly well-defined. As regards money we are able to give a certain amount through the Indian Research Fund Association for research and this increases our powers of control very definitely.

1328. Then you spoke of the difficulties in regard to quinine. Can you give us any idea of what the annual cost of quinine imported into India is?—I cannot give you figures off-hand. I could let you have them.

1329. Is it possible for India to produce a sufficient supply of cinchona from her plantations to meet her own requirements?—We have been told by our experts that it is possible to do it.

1330. These plantations have been in existence for 50 years or more; what is the reason why they have not been extended?—They have not been extended under central control.

1331. They have been left to the Madras and Burma Governments?—No, the Madras and Bengal Governments.

1332. In what other parts of India can it grow?—In Southern Burma. It is growing in the Mergui Archipelago and in Tavoy and Tenasserim.

1333. It requires a heavy rainfall and a high altitude?—A certain altitude and heavy rainfall with the humid tropical atmosphere you get at that latitude.

1334. At what altitude does it grow?—It grows in the Annamalais. This depends on the bark. Some barks grow better at 3,000 feet than others. There are a great many factors. The exact conditions surrounding the growth have been very carefully worked out by the Botanical Department. And they are contained in this report of the Government of India?—They are contained in several reports.

1335. I think you mentioned some Committee which sat last year?—There was a Committee which sat in regard to the economic aspect of quinine production and it incidentally touched on the reports of various committees which have sat from time to time. The reports of those committees will contain all the information you require. Many committees have sat on the cinchona question.

1336. But nothing effective has been done?—I should not say that; but from the point of view of the numbers requiring treatment in India, and having regard to the fact that quinine is our sheet anchor in treatment, the position at the present moment is not satisfactory.

1337. Do you regard quinine solely as a cure or as a preventive as well?—Both.

1338. Can you give us a memorandum on this subject of what can be done to increase the cultivation of cinchona in India, with definite facts and figures?—I could: but might I recommend that probably much more exact information could be got from the Director of the Botanical Survey. Mr. Calder who is now in charge of the Botanical Survey, the Bengal plantations and the Government of India plantations in Mergui, knows the position very well; much better than I do.

1339. Then you are asked whether you would not recommend the introduction of primers of hygiene in primary schools. Is it the case that lessons in hygiene are included in the primers now in use?—I have no precise information. From what I know of the work done many years ago in regard to getting primers prepared, I do not see why they should not be in the schools now.

1340. Would you advocate separate primers of hygiene or the introduction of lessons in hygiene in the existing primers?—I would advocate lessons in hygiene in the ordinary primers graduated for the age of the scholar. I think in the United Provinces there was actually a health primer produced.

1341. Your Department would be prepared to advise in preparing such lessons?—Certainly.

1342. You have not already done it?—Under the present organisation I have not done so; but this is a matter which came within the purview of the Education and Health Departments before the War. I know, because I sat on a Hygiene Educational Committee in the United Provinces before the War, when Lord Meston was Governor, and when this particular aspect of the question which you are suggesting now actually received our consideration.

1343. It is probable that such lessons are included in primers in different Provinces, but it is possible that they might be brought up to date?—It is probable that they are included in some Provinces and not in others, but the whole question should be investigated.

1344. What part of India are you chiefly acquainted with?—Northern India, from the North-West Frontier to Bengal.

1345. *The Raja of Parlakimedi*: May I know what the difficulties are in the way of improving village sanitation, in increasing the number of sanitary inspectors, etc.?—I think it is a question of money entirely. The matter of the personnel comes in to a certain extent, you must have trained personnel up to a point, but this personnel is usually forthcoming if the money is.

1346. You think the pay is not sufficient?—It is not a question of the pay so much as of the fact that the budget allotment for it does not exist in a great many Provinces. I mean it is evolving now.

1347. Is it the intention of your Department to train more men than are being done at present?—I do not know details of what the Provinces are doing. There is no central organisation. I am only advising the Government of India. I am not an executive officer.

1348. Has this matter attracted your attention and have you suggested to the Central Government that the Provinces should have more centres for training sanitary inspectors?—No, I have made no suggestion.

1349. Is there any specific preventative such as inoculation for diarrhoea which is appearing in an epidemic form in Madras?—Not for diarrhoea, there is a serum for dysentery.

1350. Is there something for typhoid also?—There is a preventive vaccine for typhoid.

1351. But dysentery and typhoid are not being tackled as epidemics at present in any Province?—We have not got epidemics of typhoid at present. Dysentery from time to time becomes very prevalent and it is treated in accordance with our latest ideas by inoculation, if it is of a particular kind. There are two kinds.

1352. Both kinds are very prevalent in the Madras Presidency, especially in rural areas. As regards the milk supply in rural areas, has the Health Department ever thought of suggesting measures to the Agricultural Department which controls dairies?—So far as I know not in rural areas. Of course, there have been many proposals for the control of dairies in cities.

1353. Has anything been done through the Municipalities and District Boards in regard to this matter?—Naturally I cannot speak for the whole of the municipalities of India, but I have not the slightest doubt that advanced District Boards have had the question of dairy control under their consideration on many occasions and have taken the advice of their local Health Officer, the Civil Surgeon or Assistant Director of Public Health. But you are asking a very general question now.

1354. Has the Sanitary Department ever thought of meeting the difficulty in regard to the milk-supply?—In towns yes; they are thinking of it now. There is hardly an organisation in the country which could tackle the question of milk control in the rural areas of India.

1355. Is the mosquito the only agency by which malaria is carried into the human system?—We believe so.

1356. Has any definite altitude been fixed for the cultivation of cinchona?—I think the limitations of growth for commercial purposes are well recognised by the botanical experts and the extent of the rainfall also.

1357. *Sir James MacKenna*: There was one disease to which no particular reference was made, that is, tuberculosis. Is that more prevalent in rural than in urban areas?—I should say more prevalent in urban areas. Our difficulty with tuberculosis is that it is not a registrable disease and our figures now are very largely hypothetical. We have had some very definite and precise statements made in public utterances in regard to the increase of tuberculosis; but we have no definite statistical evidence that those statements are anywhere near the truth. Tuberculosis has occupied the attention of the Government of India for the last 20 years and even as far back as 1910-11-12, when Colonel Leslie was Sanitary Commissioner, he made the statement I am making now, that though it was claimed that tuberculosis was on the increase there was no proof that it was. I do not say that it is not on the increase, but it is extremely difficult to be on sound ground statistically in regard to it.

1358. *The Chairman*: Is the incidence of tuberculosis mainly in the pulmonary forms?—Mainly in the pulmonary forms.

1359. *Sir James MacKenna*: I put the question because it is asserted that there has been an increase in my own Province. With reference to the statistics at page 141, apart from deaths from definite diseases like cholera and small-pox, the figure for fevers is enormous and I suppose it covers a multitude of other causes. Do you put much faith in these figures of fevers?—Those are the mortality figures. We apply a correction figure of one-third to one-quarter in estimating deaths from malaria. This has been based on individual verifications of death in certain areas.

1360. When I inspected health registers in Burma I usually found that anyone over 60 was put down as having died of old age, and anyone under 60 as having died of fever?—For practical purposes we come approximately near the truth.

1361. In regard to cinchona I take it your idea is to have centralisation the arrangements can be made?—That is my idea.

1362. The position became very acute during the War?—It did.

1363. With reference to the Burma scheme of plantations in Mergui, they cut down the area?—They were rather unfortunate in having a large area washed out. I think the Mergui area is really the functioning area now and that ought to be bearing somewhere about 1930.

1364. That is under the Central Government?—Yes.

1365. Then with reference to publicity, the Chairman asked you a number of questions about the cinema. Have you used the poster much in publicity work?—I think the Provincial Bureaux are using the poster very much now.

1366. Have you heard of any public opposition to them and demands for their withdrawal?—No, I have not heard of any. I have often wondered why.

Again my unfortunate Province provides an example. A wonderful poster on the effects of small-pox was produced, but it had to be withdrawn.

1367. *Professor Gangulee*: In the last sentence of your excellent note, you state that expenditure upon public health is a sound investment. Can you kindly tell us, if it is a sound investment, what are the obstacles to persuade the finance people that the money ought to be granted. In other words the Finance Departments will not subscribe to your view that it is a sound investment?—The Finance Department naturally looks upon anything connected with public health in the same way as it looks upon any other subject. It preserves a very neutral attitude as to the merits or demerits of a particular question. I am only giving you my own impression. The result is that very often what we consider a very necessary thing is turned down for reasons which we know nothing at all about.

1368. Although it is considered a sound thing?—Yes.

1369. What is the total revenue spent on medical relief and kindred activities?—I said I did not have the figures.

1370. At page 141 of your note you say 'the aim of the Government of India is to provide the basic structure on which this organisation can rest'. What basic structure have you in mind?—The machinery by which public health is controlled throughout the country: that is, the provincial public health organisation as represented by a Director of Public Health and his Assistants, by District and Municipal Health Officers and Sanitary Inspectors. That is the basic structure.

1371. You make the interesting statement that mortality affects agriculture. You know perhaps that it is asserted that the increase in population in India is one of the causes of our poverty because it is said that the pressure of the population on the cultivated area is excessive. Do you agree?—I think it undoubtedly contributes. I am not referring there to the depopulation of the whole country. We know that in certain areas where depopulation has followed certain occurrences the effects of that depopulation have been obvious. But, generally speaking, the increase of population throughout the whole country must naturally cause in certain areas very definite economic pressure.

1372. In that case a high mortality rate really affords relief to agriculture?—Not necessarily. Your high mortality rate may remove your workers at their very best age period so far as agriculture goes.

1373. Is the female mortality greater than the male mortality at all ages?—No, it varies in different Provinces at different times. The male mortality during the working years in all populations is usually higher than the female mortality: that is, during the period of exposure to the greatest risks, say, from 20 to 40 years of age.

1374. I am referring to Mahommedan females, for instance, in Bengal. There is a larger mortality amongst them; and so is the case with Hindu females in the Punjab than amongst men. How do you explain that? Is it

due to the *purdah* system or anything of that sort?—Well, it has been generally supposed that the *purdah* system has not been beneficial to the health of women.

1375. You have put a great deal of emphasis on Indian dietaries and their effect on health. Have you any definite suggestions to make for improving the dietary?—I have made a suggestion that we want to spend more money on research in regard to this to find out what the truth of the position is at the moment.

1376. Do you think the Agricultural Department can assist in the matter by the introduction of new crops?—Not until the facts are known. They can assist by co-ordination of research work in a central institution. If such an institute could be established I should say that it should not necessarily be a medical research institute only, but a place where workers from other departments could correlate their work.

1377. For instance, research on dietaries?—That would only be one section. There would be another section inquiring into disease and so on.

1378. Coming to the question of malaria, do you agree that the prevention of malaria must be the combined task of the engineers, sanitary experts and medical men and should not be confined, say, to medical authority?—Generally speaking I should say, Yes. You must remember that the problem of anti-malarial operations is one which requires that each scheme should be considered on its merits.

Conditions which may be applicable generally to a particular place may not be applicable to another place so that it might be possible to envisage anti-malarial operations which might be controlled by the advice of one man. But I find there may be other anti-malarial operations which could not possibly be controlled easily that way and might require the co-ordinated advice of the three people.

1379. For that reason I suggest that in Panama, the Federated Malay States, or any other part of the world where this has been done, you find that there was this co-ordinated effort. The medical men, the sanitary experts, and the engineers, all combined to improve the conditions of particular areas. Can such a combination of efforts be made in this country?—I think so.

1380. It is often asserted that the railway embankments have interfered with the natural drainage of the country. Do you agree with that?—In certain areas. Yes. In Bengal, I believe.

1381. Do you think the silting up of rivers in some parts of the country is responsible for the prevalence of malaria in those parts?—One of our authorities insists that that is one of the causes.

1382. Referring to the remedies for malaria, is there any shortage of cinchona and quinine production in this country?—Yes, there is.

1383. Could you give us an idea of the profit balance on the sale of quinine for the last ten years?—Those figures are all available in the annual reports of the Bengal cinchona factory and of the Madras factory, but I cannot tell you off-hand.

1384. Are you satisfied with the existing methods of its distribution among the rural population?—No. I think they might be improved. But you have to have a very definite cheapening of the drug before you can think very seriously of improving the distribution.

1385. At the present moment you do it through the post office?—That is one method.

1386. You are aware of the existence of certain fever mixtures sold in the rural areas. Is there any control over such drugs?—None.

1387. You agree of course that the Central Government is quite conscious of the fact that cinchona cultivation is essential and you said that opportunities have been missed which Java has seized. What is your explanation of this apathy?—The opportunity I am referring to is the complete central of

the production of bark at a period when it was recommended. Had the Central Government controlled it on a big enough scale then, we should have been in a position to be absolutely independent of other countries.

1388. What was there to prevent the Government from taking such steps?—It goes back to before my time and I cannot speak as to that. It may have been financial or it may have been that the Central Government did not want at that time to embark on the risks connected with manufacture.

1389. The whole question of cinchona is in the hands of the Botanical Survey?—The Bengal portion but not the Madras portion.

1390. To what extent has the Java trade affected our Indian market in quinine?—We are only producing somewhere about one-tenth of the supply of quinine in the world. I think that is what it is. I am talking subject to correction, but I think it is about a tenth.

1391. Is the Java market likely to oust us?—It has ousted us. The Java market is controlling prices at the present moment.

1392. It is the Dutch manufacture?—We are importing from Java at the present moment.

1392a. On page 146 you say that the therapeutic needs of India are deserving of every attention and encouragement by the Agricultural and Forest Departments. You are referring to cinchona cultivation there. Do you mean to say that this work should be taken up jointly by these Departments of Agriculture and Forestry?—I think that perhaps if the Forest Department had taken it over initially 40 years ago, it would have been a good proposition at this moment. This is my personal opinion.

1393. My point is, what can the Agricultural Department do?—I think the Agricultural Department has some say in these matters in Madras. I think the Agricultural Department comes in, in connection with the factories there.

1394. You could not suggest a definite line of action that the Agricultural and Forest Departments could undertake?—It is rather late in the day at the present moment. There are a great many interests involved in this; there are the financial interests which the two Provincial Governments have put up for the particular factories which have been created. I could not answer your question definitely because all these interests would have to be taken into consideration in any scheme of future control.

1395. Referring to the team work which doctors, chemists, botanists and others could do together, do you propose to achieve these results by establishing the All-India Research Fund Association that has been suggested in the memorandum?—The All-India Research Fund Association exists at the present moment; it is already established.

1396. You would entrust that organisation with this task?—The task of co-ordination?

1397. The team work to which you refer here?—Not necessarily; I did not suggest that at all. This Research Fund Association is functioning as far as medical research is concerned and would naturally be kept apart for medical research; but I was looking at it from the larger point of view of the co-ordination of various types of research which were bearing on a particular problem.

1398. How do you suggest that this team work which you desire could be achieved?—Well, one of the methods is in regard to diseases which could be dealt with in the institution which I suggested, on the lines of the Japanese institute, for instance.

1399. You would have another institute in which doctors, chemists and botanists would all co-ordinate their research?—For a particular purpose.

1400. Do you not think the Tropical School of Medicine could undertake such work?—As regards direction, perhaps yes; but not as regards accommodation at the present moment.

1401. Do you carry on any propaganda work in rural areas, I mean systematically?—The Provinces do.

1402. And is any impetus given by the Central Government?—Well, through communications with the Directors of Public Health, yes, and through the Red Cross. But not directly.

1403. Has there been any attempt to suggest to the Provinces the introduction of the subject in the system of adult education?—Not otherwise than through the ordinary methods of public propaganda; that is, exhibitions at fairs, here and there cinematograph and magic lantern exhibitions, and so on.

1404. But not definitely through the existing adult schools?—Years ago, in pre-war days, in 1910-11-12, at all the fairs in the United Provinces you could find an exhibition of the actual facts of malaria for the populace to learn and digest if they cared to. They were very popular. I do not know if they are going on now.

1405. You made a reference to thymol as being a very effective medicine for hookworm. Do you not think thymol can be manufactured in India?—I do not suppose there is any reason why it should not be. I do not know the commercial aspects of the question at all.

1406. At the present moment there is a certain amount manufactured in this country and exported to New York. It comes back in the form of Listerine and other forms of drugs. As it is produced from *ajwan* seeds, do you think there is any scope for its cultivation in this country?—I should be prepared to leave a question like that to experts in pharmacology.

1407. Some years ago, there was a Committee which submitted a report to the Government of India showing the possibilities of drug cultivation in India, the cultivation of things like *bella donna*, *nux vomica*, etc. Could you tell us what happened to that unpublished report of the Committee?—Was that a War Committee?

1408. I think it was in 1915-16?—I think the Committee is defunct now. But the difficulty with all this is that, if you have proved a plant to be capable of producing a drug which is efficient, it does not necessarily follow that it is a simple matter to introduce that drug as an indigenous product into India. We have a case in regard to the drug *santonin* which we have demonstrated can be produced from a shrub which is abundant in Kashmir. Well, despite that demonstration, no Indian firm of chemists would take it up and it was left to a European firm to take it up. They are now removing the *santonin* and having it manufactured and sent out. These are the handicaps.

1409. *Mr. Calvert*: I am very grateful to you for this very interesting note you have given us and in spite of the long ordeal which you have been undergoing, may I put a few questions to you? I was rather struck by page 140 of your memorandum in which you give a list of headings on this question of hygiene; I see you put education last?—They are not in order of priority.

1410. Then you give some very interesting matter on the efficiency of labour as affected by health conditions. In a number of the memoranda submitted to us we have been told a great deal about the shortage of labour. Would you be inclined to make a distinction between, say, the shortage of labour power and the shortage of labourers?—Yes, they are two different things altogether.

1411. Then you get on to this question of diet. To a large extent of course you know that the people of this country cultivate solely for food, so that this Royal Commission on Agriculture is very largely a Royal Commission on Diet. I was rather surprised to hear you say, in answer to a question put by Sir Henry Lawrence, that you had no details of any very marked changes in diet during the past 25 years. Has there not been in Northern India a very much bigger consumption of fruit?—Are you referring to the Punjab?

1412. Well, we know there has been a great increase in the cultivation of fruits and presumably the consumption has increased in proportion. The same is true of vegetables, English vegetables and so on?—I could not make a definite statement in regard to the use of English vegetables amongst the Indian population. Undoubtedly, as far as Europeans are concerned, there

has been a very definite improvement in the cultivation of both fruits and English vegetables and the amount consumed.

1413. It struck me that your answer to Sir Henry Lawrence gave a good illustration of lack of co-ordination. During the last 25 years the area under cultivation in the Punjab has increased by a million acres and there has been no increase in export. Does not that rather point to the increased consumption of wheat?—These are points I have not had time to go into fully. I began my memorandum by stating that I have been very hurried over this and there are a good many points that I wanted to verify.

1414. You did mention, I think, the increased consumption of wheat in Bengal?—In Bengal, yes.

1415. On page 145 you refer to the influence of irrigation on health and give an instance of where a badly-designed canal led to ill-health in Karnal. Would you say that increased ill-health was due to irrigation or lack of drainage?—As far as I understood the position, there was no drainage at all initially; I mean there was no drainage project. Undoubtedly that must have accentuated the conditions of water-logging which I refer to later.

1416. The point is, it is more a question of drainage than irrigation?—It is not irrigation *per se*, but drainage or rather want of drainage.

1417. As far as your investigations go, would you be prepared to say definitely that there is a higher mortality from fevers in irrigated than in non-irrigated districts?—I think, generally speaking, one would be on firm ground in saying there was.

1418. You have seen that note in the Punjab Census Report in which this is discussed in some detail?—I read it some time ago.

1419. That shows practically no connection whatever between irrigation and malaria. Your note, as it stands, suggests there are some evils attending irrigation?—I think this is another of the questions where we want a considerable amount of further research in order to clear up different points of view. We have had assertions made that there has been an intimate connection between the two, and then we have this statement in the Punjab Census Report showing a diametrically opposite point of view; this has occurred not only in regard to one area, but in regard to several areas and we require more light on this than we have. It is for that reason that I thought there was a possibility of some of these points being cleared up in the future owing to the extension of our malarial department.

1420. *Dr. Hyder*: Does not Mr. Howard mention that as one of the problems to be investigated?—He probably does. We hope to be able to get on with this at once because we are bringing in two very expert officers for the purpose and we hope to put them on to problem exactly like this when they arrive.

1421. *Mr. Calvert*: Some of our memoranda refer to quinine as being a Dutch monopoly. I understand that there is no question of a monopoly; there is nothing to prevent India producing as much quinine as she requires?—Nothing at all.

1422. Do I understand from you that if you did inaugurate a big campaign against malaria you would be brought up at once against a lack of quinine?—At present prices, certainly. Are you supposing sufficient funds being given to tackle a campaign as it ought to be tackled from a health point of view?

1423. Yes?—You must remember that we have a big reserve of quinine which has been created and is being added to from month to month, for the specific purpose of meeting an epidemic should one occur and also to tide us over the difficult period between 1928, when our contract for the importation of bark ceases, and 1930 when our estates in Mergui come into bearing. If that were utilised we might be able to put up a very considerable fight. Without that and relying solely on what we are producing ourselves annually we could not come anywhere near tackling the situation at all.

1424. One gentleman who has given us a memorandum suggests that we should improve the health of the rural population if we could get them to move from their villages to live on their lands more in the English farm system?—You have that exemplified in Assam. The holdings in Assam are very much on the principle of little holdings in the country at home, but there you have your *kala-azar* attacking them irrespective of where they are.

1425. So many of these theoretical considerations do not work out in practice?—In regard to certain things it might be advantageous to have them by themselves, but you are at once up against the absence of communal services which, if properly organised, can make for the comfort of a large number of people very definitely if they are living in a village.

1426. You would not describe the custom of living in villages, apart from the congestion, as a predisposing cause of ill-health?—The mere living in villages is not a predisposing cause of ill-health, but the living in villages under conditions as they exist of course is.

1427. Have you any connection with the Kasauli Research Institute?—We control it. I happen to be in control of the medical research under the Government of India.

1428. Was that in any way affected by the Inchape Committee?—Not the Kasauli Institute. The Kasauli Institute is a Government of India institute and its grants were not subject to any serious retrenchment by the Inchape Committee.

1429. Is the work there in any way being hampered by lack of funds?—No, I think the Kasauli Institute gets the money it asks for.

1430. Then the Food laboratory at Kasauli has nothing to do with you?—The Food laboratory at Kasauli is under the Army Department, and under the Quartermaster General.

1431. Is there any corresponding institution for the civil population to have food tested?—Not otherwise than in the existing institutes we have, such as Kasauli, the Haffkine Institute, Bombay, the King Institute, Guindy (Madras), and the Calcutta School. Local food research could take place in any one of these institutions. I ought to amplify that. In certain towns, for instance, Madras, Lahore and Lucknow, we have Food Health laboratories under the Directors of Public Health, in which certain investigations in regard to the purity of food, adulterations, etc., are done.

1432. I suppose we should be quite correct in saying that the value of the work done in the research Institute at Kasauli is simply beyond value? You could not put a money value on it?—A large amount of research work has been done at Kasauli just as at other institutes, but in addition to the research work there is a certain amount of routine work to be performed. It prepares the bulk of the typhoid vaccine for India; it also supplies most of the cholera vaccine and also all the anti-venine for India. The actual venine is recovered in Bombay and sent up in a dry condition and the anti-venine is produced in Kasauli, so that we have three things produced in Kasauli for the whole of India, typhoid vaccine, cholera vaccine and anti-venine. During the period of the War these activities had to be extended enormously, not only to cope with the wants of the whole of India, but to cope with our armies in East Africa, Irak, Persia, and Egypt. To give you an instance of how it affects other countries, the Federated Malay States get their cholera vaccine from Kasauli, just as many other countries get their plague vaccine from Bombay.

1433. Do you think the enormous value of that type of work is now sufficiently realised to make any financial stringency almost impossible?—I would not say by any means that it is sufficiently realised. I think that one of our chief efforts in that connection is to bring home from time to time the very great importance of it, and we are not always satisfied that we succeed.

1434. You sometimes have to bring it home to people who ought to know better?—There is no question about it.

1435. We have been hearing something about epidemic forecasts. Do you think that is coming to be of real practical value?—It has only been attempted in one Province, the Punjab, and mainly through the work of Colonel Gill. This year when I was attending a meeting in Paris I made a reference to some of Colonel Gill's work; curiously enough the Italians suggested they were doing work on similar lines; they had already read Gill's work and they thought there was a great deal in it, and they were attempting forecasts in certain regions of Southern Italy in regard to malaria. You can take that for what it is worth, but generally speaking the Punjab has been in a more favourable position to make these forecasts than many other Provinces because the Punjab has been one of the great storm centres of epidemic malaria, and I think perhaps on that account its malarial condition has been more thoroughly worked out perhaps than that of many other Provinces, taking the Province as a whole. For instance you have this system of spleen examination, which is universal. You can get the spleen rate of the Punjab at certain periods and it has been going on for several years. You cannot ascertain that from the figures of any other Province as far as I know in the same way. So that the data on which Colonel Gill is basing his forecasts are perhaps a little more precise in the Punjab than elsewhere. The value of it has got to be proved by what happens and I do not know how far you believe in it, but I think that the forecasts have been fairly near the mark in the last two years.

1436. They have been trying cholera forecasts too?—There they are on very debatable ground.

1437. *Dr. Hyder*: And small-pox?—The same. If you take Sir Leonard Roger's statements, he would lead you to believe it was only a matter of watching meteorological conditions, for instance absolute and relative humidity and winds, in order to enable you to come to a conclusion as to when you are going to get an epidemic of small-pox. I do not think it is quite so simple as that. Those are all empirical matters about which we have no precise information; they are largely theoretical.

1438. *Mr. Calvert*: A great deal of that kind of work on epidemiology has been done by officers outside the strict line of their official duties?—Undoubtedly.

1439. Does the Government encourage that kind of research?—Yes. In the general programme of research which we discuss at Calcutta at our annual conference in December, every line of research is brought under our scrutiny and we usually try to elaborate a priority programme as far as possible, and we try to work our allocation of money on that priority programme.

1440. Apart from inquiries into specific things like dietary or disease you do encourage the study of the epidemiology of particular diseases?—Yes.

1441. It is commonly stated that a pure milk diet plays a large part in the health of children, but I understand in most Buddhist countries, Japan, China, Siam and Burma, there is practically no milk obtainable. How are those two facts reconciled?—I think that so far as the young children are concerned they are breast-fed till about 2 to 2½ years. If any children are unable to be so fed they must die. If they cannot get animal milk and they cannot be breast-fed they will not survive. Of course they have goats and a large amount of goat milk is drunk.

1442. I am only trying to get a sense of proportion. There are people who assert that milk is vital and I should like to know exactly to what extent it is vital. There are those countries where no milk is obtainable?—Milk is vital for children in some form or other and if it does not exist the child is not going to subsist in any other way.

1443. *Mr. Kamat*: With regard to the relations between your Department and the Provincial Departments of Health you told the Chairman that you have no means of influencing the Provincial Directors of Health except by writing to them demi-officially?—I did not say that. I said that was one of my methods of approach, through the Directors of Public Health. But there

are other means such as by asking the Department of Education, Health and Lands to address the Local Government.

1444. When you ask the Government of India to take up a particular question on which you tender advice have they the power of direction or interference in health matters in the Provinces?—Only in regard to what the Devolution Rules have left as Reserved subjects. For instance, in epidemic diseases in certain circumstances the Central Government can step in and lay down a definite law to Provinces. Port health work in the major ports, marine hospitals, quarantine stations and international relations are all matters in which the Government of India is paramount from the health point of view.

1445. In other respects they have not the power of influencing the Provincial Health Departments?—Not otherwise than by suggestion.

1446. How do you get into close touch with the Provincial Departments of Health, with the work they are doing and the problems that are being tackled?—Almost entirely through the Directors of Public Health.

1447. Do you yourself do much touring? Do you visit every Province each year?—I tour over India and Burma.

1448. I am asking whether each Province is visited at least once a year?—My touring is regulated very largely by my visits to the major ports, Bombay, Karachi, Calcutta, Rangoon and Madras, all of which I should visit; and incidentally, while I am passing through the different Provinces, if I have time I usually make a point of seeing the Directors of Public Health and sometimes the Ministers and their Secretaries in regard to any points they may wish to discuss with me.

1449. But do you get sufficient opportunities to see into village sanitation apart from the large ports?—Not under the present arrangements unless I went to look into some specific problem.

1450. So that the position is that you have not sufficient opportunities of getting a closer acquaintance with village sanitation, nor have the Government of India power to influence the Local Governments in matters of village sanitation?—That is the position.

1451. Now as regards diet and its relation to the efficiency of the agriculturist and the population generally I would like to know from you whether you can make any practical suggestions so as to bring about at an early date a change in the national system of diet and encourage the production of particular crops in areas where they are not at present grown?—On the analogy of Great Britain and other European countries we know that certain definite changes in diet can take place over the course of fairly short periods. Increased facilities for the transport from foreign countries of fruits of all kinds and other things have shown us at home how the diet, generally speaking, of the population can alter very materially. There is no particular reason why the same changes should not take place outside of Europe. But it is extremely difficult for a European to say precisely what could be done as regards the alteration of the diet of, say, a large rice consuming community like Bengal.

1452. Did I understand you to say that it is easy in Western countries like Great Britain?—I do not say it is easy to change the diet radically, but it is easy to make alterations in diet and that seems to me to be largely dependent on the cost of particular articles and the quantities in which they are offered for consumption.

1453. *Sir Thomas Middleton:* In Britain we import the great bulk of our food supplies and in that way we have acquired a taste for a great variety of foods and have the means of satisfying them?—My opinion is that, knowing the conservatism of the Indian population, it would be an extremely difficult matter to change the basic diet of any particular Province.

1454. *Dr. Hyder:* Could you draw any conclusions from the consumption of salt. For instance, salt of a particular variety is consumed in Madras but the Bengalis like imported salt. Do you think that may be associated with racial characteristics?—I should not care to say.

1455. *Mr. Kamat*: To pursue the analogy, in one particular part of Great Britain the people are fond of porridge but not in other parts. Could you change those habits by persuasion and reverse the position?—Those of us who happen to belong to porridge-eating countries, I think, agree that the amount of porridge that is consumed now is not as large as it used to be, and probably one of the reasons for it is that various other products have been offered which are more attractive than porridge.

1456. It is not only conservatism; there is one other factor in this country on which I should like to have your valuable opinion. For instance, the people on the western coast of India in the Konkan, even if they could be persuaded to buy wheat may conceive the idea that owing to centuries of rice eating they cannot digest wheat. Is that likely to be true?—I should not think so.

Professor Gangulee: In Bengal we are consuming a great deal of wheat to-day.

1457. *Mr. Kamat*: You told the Chairman about the value of cinemas. Something is being done I suppose by the educational authorities in the Provinces to show magic lantern slides to school children. Do you think that system of conveying knowledge to children in villages should be extended very largely?—I do not know what the Education Department are actually doing in the matter of cinemas.

1458. Do you also agree that the new experiment that the G. I. P. Railway Publicity Department are making in the matter of cinemas should be extended by compulsion or persuasion on other State-managed railways?—That particular experiment which I referred to in my memorandum, and probably referred to wrongly, I thought was an agricultural experiment, as it dealt with agriculture. But I discover now that it was a Railway Board experiment. There is no reason why it should not be repeated by the various railway companies.

1459. Speaking about the *Ayurvedic* system of medicine you said in answer to one of the questions just now that certain tests were being made in connection with *Ayurvedic* drugs. In which particular Province are these tests being conducted?—Bombay and Bengal.

1460. May I know in this connection what is the character of the tests, whether it is on the raw material on which the *Ayurvedic* vairs depend or the chemical product which they turn out?—The raw vegetable product is investigated by the pharmacologist (Major Chopra in Bengal), and the active principles are discovered and tested therapeutically in the wards of hospitals.

1461. But the actual drugs made by the *Ayurvedic* vairs and *hakims* and the utility of these things are not tested?—Yes, the whole claim is being tested from start to finish.

1462. I do not know whether I have made myself clear?—Yes, you have. The claim of a particular drug to do a certain thing is being tested by recovering the drug from certain vegetable products and by exhibiting the drug in actual cases of disease.

1463. For instance, take what the *Ayurvedic* calls *Iambosma* which is used in certain diseases and weaknesses; you are testing that in certain hospitals?—That is partly the case, but as both these inquiries are being run by Indians, it is extremely unlikely that they are going to allow any *Ayurvedic* claims to pass without proper investigation. I think you may take it that, when a particular drug is being investigated or its claims are being investigated, the whole circumstances are being inquired into.

1464. What I want to make clear is that the test is not a laboratory test but is done in hospitals on actual patients?—Both. The tests are being conducted in both ways; by laboratory experiments and by actual clinical experiments involving the exhibition of the drug in actual cases of the disease in hospital.

1465. If these tests are found to be favourable, do you not think that certain *Ayurvedic* drugs may be found extremely convenient and extremely cheap for the population in the villages?—That is the *raison d'être* of the inquiry.

1466. And the publication of the results by the Government should be as broadcast as possible?—The results are already being published in the Medical Research Gazettes and in the press.

1467. You referred to the criticism of the Public Health Department by local bodies. Was there any tendency to your knowledge on the part of the members of legislative bodies to oppose measures for sanitation, or was it only criticism with the object of securing all possible retrenchment and economy?—I think I made myself perfectly clear on that point in reply to another question. I said that, generally speaking, there was the development of a sympathetic attitude, that here and there were instances where there had been opposition; but that in the general perspective I looked on that opposition as being localised.

1468. With reference to certain diseases, especially epidemic diseases in the villages and in village areas are the present methods of notification of outbreaks of epidemic diseases fairly satisfactory?—Notification of cases of epidemic disease in rural areas does not exist as it does in Europe but there is a chain of notification which enables us to get the facts very early from rural areas through the revenue and civil machinery.

1469. May I know briefly what the machinery is? Supposing there is an outbreak of cholera in a village, how long would it take for the officers of the Health Department to come to know about it?—It all depends on the organisation of the Province. For instance, if we take the United Provinces, where we have District Health Officers, it would be at once known to the *lumbaradar* of the village within probably a few hours of its happening and as the symptoms of a disease like cholera are very well known, he would lose no time in reporting it to the nearest *thana* and through the *tahsildar*'s staff also to the nearest Health Officer.

1470. Are you in favour of stricter methods, of compulsion, or penalising any negligence on the part of the village officers in this matter of reporting cases of epidemic disease?—I think we want to tighten up our system of notification of infectious diseases more and more. The only method of effectively tackling epidemic disease is to get at it early and any measure which tightens up our methods is all to the good.

1471. If a village officer fails to report a case of such disease would you make it a criminal offence, in the interests of rural health?—No, I do not think so; not a criminal offence.

1472. As everyone knows, huts and cottages in the villages are ill-ventilated, insanitary, surrounded by tethered cattle and that sort of thing. Is there any method of improving the conditions without extraordinary cost?—To my mind, the easiest method of improving it is for zamindar to improve it. If the zamindar will not improve, well then, nobody is going to do much in the village. The zamindar if he is at all enlightened could do more than anyone else.

1473. But in certain Provinces there is no system of a zamindar in each village; each man is his own master?—Yes, but the villages are owned by some landlord.

1474. *Mr. Calvert*: By zamindar you mean landowner?—Yes.

1475. *Mr. Kamat*: Would it be worth while to have a model village for instance by giving certain facilities of land where people could build, being given guidance as to how to build sanitary houses, and how to lay out streets without the insanitary conditions which are preserved by the conservatism of the villages?—There is no objection to it at all. It is all to the good and I think in the Punjab canal colonies there has been every attempt to do this.

1476. You were asked whether it was not possible that villagers should live each one on his own land with benefit to himself so far as health was concerned. The difficulty perhaps is that they do not feel secure so far as their own safety is concerned if they have to live scattered over the land?—It depends on the Province. Internal security varies so very much.

1477. Although Mr. Calvert said that certain investigations proved that there was no direct connection between irrigation and malaria, still in certain Provinces that is the prevailing feeling and also perhaps the experience. For instance, in the Deccan canal tracts people are under the impression that more villagers are stricken than before. So that the point should be investigated at an early date and the last word should not be accepted as coming from a particular investigation in the Punjab. Do you agree?—I agree to the further investigation.

1478. *Dr. Hyder*: Do you think there is any connection between night-blindness and the inferior quality of grain consumed? I notice that in the case of the coolies who are working at New Delhi, though they are not very strong they are not so bad, but that some of them cannot see at night?—We do know that certain of the inferior grains produce a chain of symptoms which have been variously labelled. For instance, lathyrism, which we are investigating just now, is a disease which is supposed to have been caused by the grain *lathyrus sativus* mixed with other grains. Our investigations all point to the fact that the grains of *lathyrus sativus* are not pathogenic as we thought in the past but that the symptoms of lathyrism so-called are due to another contamination altogether which has been discovered in the investigations. Eye symptoms of course have come in as part of the chain of clinical symptoms which we see in some villages. But for the cause of ordinary night-blindness, I think, we must look elsewhere. Nightblindness is very often associated with peculiar changes in the retina and might be a thing quite independent.

1479. *Sir Henry Lawrence*: Could you tell us a little more about this question of milk in diet? Do you regard a greater supply of milk as a very important matter for the rural population?—I think so. I have very little doubt that a population which has access to large quantities of milk is enormously benefited thereby.

1480. Is there a geographical distribution? You say there are certain areas in India where they have sufficient milk and certain areas where they have not?—I do not think there is any doubt that much more milk is consumed in certain areas than in others; which means that that amount of milk is more readily available. In the Punjab, for example, the Sikh community drink, generally speaking, fairly large quantities of milk.

1481. With good effect on their health and constitution?—We have only got to look at them to see that.

1482. Is it correct to say, as Mr. Calvert suggested, that there is no milk in the diet of the people of China?—I know the Chinese are averse from drinking milk but I cannot speak of the actual Chinese diet intimately. I have never been in China.

1483. The Chinese labourer is one of the strongest in the world?—The Chinese labourer, as I knew him during the War and as I have seen him in the Federated Malay States, is a very generous feeder; he supplements any ration he gets by buying largely and I should say that his diet is extraordinarily generous and well-balanced. It has been, I know, asserted that the Chinaman does his enormous amount of work on a very low caloric diet, but that has been disproved; we know that a Chinese labourer has a very high caloric diet, probably in the region of 4,000 calories.

1484. Then, for people whose economic condition does not permit them to have a very generous diet, you would consider milk a very important substitute and any improvement in the milk supply is a matter of very great importance to India?—A matter of the very greatest moment.

1485. *The Chairman*: Quinine was an indigenous medicine in South America, was it not?—In South America, yes.

1486. It was used there long before Bacon was born but it survives modern scientific methods of medicine as one of the few specific remedies in the world?—Yes.

1487. Do you not think it is possible that the Spaniards laughed when they saw the South American indigenous population eating the bark of a tree to prevent their teeth chattering. And probably other practices in the pharmacopœia of those natives might have been proved under investigation not to have so sound a basis. So that perhaps in considering these matters we may bear in mind the words of a not inconsiderable contemporary of Bacon, "There are more things in heaven and earth than are dreamt of in your philosophy." Is there a satisfactory explanation to account for the cyclical swing of malaria?—I do not think so. At the present moment we have had many explanations put forward, but they are still largely theoretical.

1488. Of course each year that goes on without a serious outbreak of malaria means that more and more young people are moving about who have not been infected?—That may be so.

1489. You come to a moment when there is a large proportion of the population without the degree of immunity produced by a first infection?—That of course is a very cogent reason for the cyclical attack.

1490. Do you keep in touch with circumstances existing in irrigated areas in other countries?—I am in touch with practically all the countries in the world in regard to health statistics. My bulletins reach practically all countries, and I am in receipt of information from all the leading countries of the world in regard to what is happening.

1491. Are you familiar with the malaria statistics in the area irrigated by the new so-called *Sennar* or *Makwar* dam on the Blue Nile?—I have the details, but I have not studied them at all.

1492. They are interesting and I commend them to you for this reason. I happened to be there myself this year. There is no malaria at all there although the area is irrigated, and that is accounted for by the local medical men by the fact that every canal is cut with a sufficient slope to give the required velocity to the water to prevent the breeding of the anopheles mosquito. Curiously enough when I was there there was a small outbreak of malaria, which proves that the conditions are malarious but it was at once traced to the fact that a run-off had been led into a natural water-course which was supposed to have no part of its bed at a less slope than that required for safety, but that there had been an error in the survey. The water had slowed up, anopheles had bred and malaria was present. But otherwise, in that large and important irrigated area under high conditions of cultivation, there is no malaria I understand whatever. That would be very significant if that is so?—It would be, but there is the other factor that the conditions there have not been operating for a very long period. I am not quite sure of the actual date of the commencement of the *Sennar* dam, but the moment you cease to have close attention to the disposal of a particular amount of water on a particular amount of soil the conditions of overflow set in, as they may very easily do with flow irrigation. Then your whole malarial problem assumes proportions which perhaps it would not assume in the early stages of very effective control in a new work.

1493. Are venereal diseases an important cause of inefficiency amongst the agricultural population of India?—In connection with the approaching visit of the Social Hygienic Council delegation to this country I have said officially to the Government of India that they are not. Of course, we do know that in our large ports they bulk very largely and in certain areas, for instance in Burma, we know that the problem is a more serious one than it is generally in India. In certain hill tracts it exists, but generally speaking, my experience is that in the rural districts it is not a serious problem.

(The witness withdrew.)

APPENDIX I.

Statement showing the profit or loss of the Madras Cinchona
Department from 1915-16 to 1925-26.

(Furnished by the Government of Madras.)

Year.	Profit.			Loss.		
	Rs.	A.	P.	Rs.	A.	P.
1915-16	9,51,624	15	1	.....	
1916-17	22,62,657	1	3	.....	
1917-18	3,42,758	14	9	.....	
1918-19 . . . . .	.....			1,59,655	10	10
1919-20	3,32,599	2	11	.....	
1920-21 . . . . .	.....			31,368	6	11
1921-22	5,68,470	0	11	.....	
1922-23	3,55,486	3	2	.....	
1923-24	2,52,519	4	4	.....	
1924-25	3,28,115	10	7	.....	
1925-26	1,79,097	7	7	.....	

NOTE.—In 1918-19 there was a disastrous fire at the Factory.

APPENDIX II.

Statement of the profit and loss account of the Bengal Cinchona
Factory for the years 1915-16 to 1924-25.

(Furnished by the Government of Bengal.)

Year.	Profit.			Loss.		
	Rs.	A.	P.	Rs.	A.	P.
1915-16	3,49,705	5	0	.....	
1916-17	9,76,394	11	6	.....	
1917-18	24,10,548	14	8	.....	
1918-19	1,68,806	3	9	.....	
1919-20	5,39,602	2	11	.....	
1920-21	7,62,177	12	3	.....	
1921-22	8,82,095	4	2	.....	
1922-23	7,64,446	6	3	.....	
1923-24	5,73,935	10	3	.....	
1924-25	5,17,336	5	4	.....	

APPENDIX III.

A note on the Activities of the Indian Red Cross Society in the field of Public Health by Sardar Bahadur Balwant Singh Puri, Ag. Organising Secretary.

The Indian Red Cross Society owes its existence to the Great War. In 1916 the operations of the War spread in the East to an extent which directed the attention of the British Red Cross Society and the Order of the Hospital of St. John of Jerusalem in England, to the urgent need for a Red Cross organisation in India to cater for the needs of the Army operating in the Eastern theatres of War. The result was the formation of the Joint War Committee of the Order of St. John of Jerusalem and the British Red Cross Society; Indian Branch.

The operations of the Joint War Committee expended proportionately to the expansion of the military forces, and after the armistice was signed, its resources which had by that time developed considerably, were directed to the relief of the Army engaged in Frontier warfares. While the Committee was thus occupied, some of the larger Red Cross organisations were impressed with the fact that if the forces of the Red Cross as a whole were to be demobilized with the demobilization of the military forces, and the enthusiasm aroused by the War were allowed to lapse, there would be lost to the world one of the few important results of the War which might be preserved in the interest of mankind.

A conference was accordingly held at Cannes (France) to formulate an extended programme of Red Cross activities in the interest of humanity. In addressing itself to this task, the Conference expressed it as its belief that while every measure should be taken to repair the ravages of war, it is no less important that most serious attention should be paid to the prevention and amelioration of the ever present tragedies of unnecessary sickness and mortality which occur in the homes of all peoples. The conference therefore came to the conclusion that it was most important to the future progress and security of mankind that intelligent steps be taken to instruct the peoples of the world in the observance of those principles which would contribute to their health and welfare, and that the Red Cross Societies of the world were the best means to carry out this object.

The conference closed its labours by the foundation of a League of Red Cross Societies with headquarters at Geneva (subsequently transferred to Paris), with the object of stimulating and co-ordinating the voluntary efforts of the peoples of the world through their respective Red Cross Societies in promoting the development *inter alia* of sound measures for public health and sanitation.

In 1919 an invitation was received from the League of Red Cross Societies for India to join it as a member. Steps were at once taken to dissolve the Joint War Committee and to establish an Indian Red Cross Society by an Act passed by the Imperial Legislative Council in March 1920. Thus the Indian Red Cross Society came into being with a programme of work to promote effective measures for human betterment under conditions of peace. The objects to which the funds of the Society may be applied are:—

- (1) The care of the sick and wounded men of His Majesty's Forces, whether still on the active list or demobilized.
- (2) The care of those suffering from tuberculosis, having regard in the first place to soldiers and sailors, whether they have contracted the disease on active service or not.
- (3) Child Welfare.
- (4) Work parties to provide the necessary garments, etc., for hospitals and health institutions in need of them.

- (5) Assistance required in all Branches of nursing, health and welfare work, ancillary to any organisations which have or may come into being in India and which are recognised by the Society.
- (6) Home Service Ambulance Work.
- (7) Provision of comforts and assistance to members of His Majesty's Forces, whether on the active list or demobilized.
- (8) Such other cognate objects as may, from time to time be approved by the Society.
- (9) The expenses of management of the Society and its Branches and affiliated Societies and Bodies.
- (10) The representation of the Society on or at International or other Committees formed for furthering objects similar to those of the Society.

The creation of an intelligent demand for better health conditions and the dissemination of knowledge of the means of securing them have been one of the most important items of the Society's programme of work ever since its foundation.

A survey of the field made it clear that the very rudiments of public health are unknown to the great masses among the people, and that a prolonged intensive campaign of education in the alphabet of health was necessary. Steps were at once taken to compile short and simple literature, posters and magic lantern slides aiming at:—

- (a) the awakening of the people to the advantages of the hygienic equipment already at their disposal, and to the necessity of providing more;
- (b) the education of women in motherhood, child welfare, health, nursing and general hygiene;
- (c) the education of the people in the elements of the diseases which are most prevalent in India.

By the end of 1923, the Society was able to publish—

- (1) 20 separate booklets and leaflets dealing with the A. B. C. of health, the causes from which the commoner diseases spring, and the simple methods of dealing with the diseases themselves;
- (2) 21 graphic coloured posters illustrating the same subjects;
- (3) 7 different sets of lantern slides appropriate to Public Health; and
- (4) a considerable quantity of miscellaneous material for special or local use.

Booklets, etc., on other subjects have since been added to the above list according to demand, and in the end of 1925, the Society had published 31 pamphlets in English, as well as in all the principal vernaculars of the country. In addition to these, eight interesting and instructive cinematograph films dealing with problems of health have been obtained from the League of Red Cross Societies and are being widely shown.

During the last three years the headquarters organisation of the Society has spent a sum of Rs. 1,40,500 in the preparation and printing of its public health propaganda material and distributed about 10,00,000 pamphlets. The distribution of this material is carried on through the Provincial Branches of which there are now 24 including 6 in the Indian States. The Education and Public Health Departments of the Local Governments have been of great help in distribution of this literature. The officers of these departments have carried the message of the Society far and wide by disseminating its literature and other propaganda material in the mofussil. In the United Provinces, the Hygiene Publicity Bureau of the Public Health Department actually carries on this work as a part of its normal activities and the Provincial Branch of the Society pays to it an annual subsidy. In the Punjab, with the active co-operation of the Education and Public Health Departments, every district now possesses a magic lantern for health propaganda purposes. In Burma

too, the Public Health Department is closely associated with the public health activities of the Provincial Branch.

This, in short, is the general outline of the aim, programme and activities of the Indian Red Cross Society in the direction of improving the health of the people as a whole. These are only the beginnings and they have touched only the fringe of a vast field, and as the progress must be slow and steady it is yet too early to comment upon the effect of the steps which have been taken. The two other cognate items in the health education programme of the Society are:—

- (a) The Junior Red Cross.
- (b) Public Health Nursing.

The Junior Red Cross is intended to enlist the sympathies of boys in the schools in the aims and objects of the Society. The object of this organisation is to prepare the child to be a useful member of the community and a good citizen of the country, and in effect to accustom him to consider the needs of others by training him in affection and sympathy and co-operation with his neighbours. The programme of activities include the care of health in that a child should know how to care for his own health and to help to protect the health of others. This is achieved by

- (a) health instructions and certificates courses in hygiene, first aid, diet, etc.,
- (b) some sort of competition in the observance of simple health rules, and
- (c) lessons on community health by making surveys, under suitable guidance, of the local sanitation, water-supply, street cleaning, etc.

With regard to public health nursing, it has not yet been possible, owing to other pre-occupations, to inaugurate any scheme but it is the aim to create a service of Indian Red Cross Public Health Nurses. The Society lately deputed an Indian nurse to England to receive a special course of training in public health nursing at the Bedford College of Women, London. She has just returned after completing the course and after visiting some of the leading nursing institutions in Belgium and Germany, and is being appointed the Principal of the Training School of Nurses of the Poona Seva Sadan Society which provides trained nurses to Institutions in Southern India and elsewhere. It is hoped that she will be able to stimulate the interest of the better class Indian ladies in the profession of nursing.

Mr. J. H. FIELD, M.A., B.Sc., Director General of Observatories.

Memorandum on Indian Meteorology in relation to Agriculture.

The terms of reference which have led to this memorandum involve the questions:—

- (a) What has the Meteorological Department done for practical Indian Agriculture in the past?
- (b) What could be done in the future, given adequate means?

2. The Meteorological Department has for some 50 years been collecting Indian data of a climatological nature, and has discussed them in published Memoirs of some 23 volumes, too heavy to hold with comfort: they form the solid basis on which any system of further meteorological enquiry for India must rest, and have current application in periodic publications on weather, in cyclone-warning at sea, and in flood and wind warning on land. Valuable as these activities are, they fill but a small part of what a live meteorological department should undertake, but in India they have always absorbed the bulk of the available weather budgets; for it is unfortunately the case that until a few years ago, when measurements of upper-air characters began to draw some small quantum of financial support from Government, no representation of the department was able appreciably to raise its funds towards a level suitable even for departmental purposes, apart altogether from any direct help to agriculture.

3. However needless it may seem in these days, with the Agricultural Commission threatening the Gate of India, to point out the intimate connection between Weather and Agriculture, I have constantly been impressed in the course of my many years' work in this country with the too scanty official realisation how intimate and detailed that connection is, and how fruitful must be a well-equipped programme of co-operation.

This drawback is little apparent in countries abroad. From early in the nineteenth century America emphasised the matter as calling for enquiry and study, and has since taken progressively vigorous action, with most other nations following suit; but, from the nature of the pre-occupations of the East India Company in the earlier half of that century, nothing on similar lines was possible then, and very inadequate attention was paid to the subject by Government in the latter half of the century. Even within the last ten years the only attempt, I believe, that has ever been made to deal seriously with this relationship for India on statistical lines (the very first step in aid of agriculture) was regarded so unsympathetically in official quarters that it could not be continued: it was judged to be "only scientific" and essentially condemned. This attempt was by Mr. S. M. Jacob, I.C.S., who for years spent his personal leisure, and from time to time employed his private purse, to work out the body of statistics which appear in his admirable papers:—

"Correlation of areas of matured crops and rainfall": Memoirs of the Asiatic Society of Bengal, 1910, Vol. II, Part 11.

"Correlation of rainfall and the succeeding crops with special reference to the Punjab". Indian Meteorol: Memoirs, 1916, Vol. 21, Part 14.

It is to be feared that, with respect to India's inaction, a candid but irreverent critic (could any such be found) might even venture, having bared his head, to whisper, with Edgar Allan Poe,

“ And I rest so composedly

Now, in my bed,

That any beholder

Might fancy me dead;

Might start at beholding me

Thinking me dead ”.

4. It may be said, then, with regard to question (a) above, that, apart from laying the meteorological foundation on which to build in aid of agriculture, very little has yet been done, in spite of the example of other countries: but with the coming of the Agricultural Commission, and with an open examination of the subject, all this should be changed, for it is now impossible on any grounds short of communal war or of bankruptcy to condone further neglect.

No prospect of added usefulness would be more eagerly welcomed by this Department than that of co-operation with agriculture on a definite and considered programme; but budget allotment must be suitably expanded, or the work be still refused.

5. The question remains “ What could be done in the future, given adequate means?” and in considering a suitable programme and its cost, an account in outline may be given of what is done in other countries.

England.—The Royal Meteorological Society began to collect systematic phenological data as early as 1875, and these have for many years been regularly analysed, discussed and published. Besides the ordinary collecting stations there are now, under the British Meteorological Office, some eighteen “ crop-weather stations ” with objects specially agricultural.

From 1900 onwards it came to be recognised that the meteorological organisation was inadequate generally, and could not deal with this and cognate matters of moment to the British farmer, and the other public services affected by weather; the official budget was accordingly raised from about £29,000 in 1913-14 to some £120,000 in 1923-24 with officer staff expansion from 9 to 40 in the same period. In a recent reply to an enquiry whether England could supply, if needed, a British Meteorologist for Karachi when the airship flying programme matures, the Director of the British Meteorological Office replied that it was perhaps doubtful, for his organisation was so continuously increasing in size that he found difficulty in recruiting and training men for his own ranks.

To fix our ideas it may be mentioned that over the period of 10 years named above, while Britain expanded its meteorological budget and staff some four fold (with income-tax at 4s. 6d. in the £) India raised her officer staff by only 3 men, and her budget by 25 per cent. Some improvement on these figures has since occurred, but not enough to cope with the needs of agriculture.

America spends on meteorology roughly 10 times as much as India.

America, U. S. A.—The Weather Bureau was established in 1870, with agricultural objects among others. It issues telegraphic weather information on a large scale to farmers, with warnings against floods, winds and especially against frost. These services are regarded as very valuable over the countryside. Its main periodical, the American Monthly Weather Review, is full of excellent articles of direct current use to agriculture, and is a production such as we could not imitate in India with present staff strength, even if the cultivator were trained to use it. There are agricultural experimental stations

in 12 regional areas interested respectively in corn, cotton, wheat (2 seasons), potatoes and other crops, and one of their main enquiries relates in great detail to the critical periods of plant growth in association with weather. Very thorough experimental means are adopted for determining the optimum conditions of temperature (degree and duration), radiation, and moisture in air and soil, during the several periods of fruit production. Their dealings with coming frost are, I believe, particularly valuable to fruit farmers, who, on warning received, take steps to protect their orchards with low-lying smoke screens. The Americans have definitely concluded that they have now a basis of experience reliable enough to let them predict dates and periods of seasonal events for all latitudes and longitudes in United States of America, according to what they term their bio-climate law. That claim may be well-founded is indicated by their weather insurance systems, which deal with all meteorological features separately; some of them are run by the individual States themselves, and so complete is the weather information that premium rates (for instance, for hail) vary with the kind of crop and the location of the fields in which it lies.

South America—The Argentine.—Sir Frederick Gebbie, who knows that country well, informed me that a very active meteorological organisation exists, to which on all occasions the country farmers apply for forecasts and warning information for agriculture.

Canada has recently started operations similar to those of America.

Russia, according to available information, seems to have been early (1896) in the field with experimental stations, and by 1912 had 81 such institutions, large and small. They paid special attention to determination of the critical periods of growth in field crops, in relation to weather.

Brazil, Germany and France instituted, in 1910, 11 and 12 respectively, separate divisions of their weather organisations for work on agricultural meteorology.

6. With these examples before us, it is possible to put forward a scheme of work as a basis of discussion, and this scheme I would divide into two heads (i) Statistical, (ii) Experimental. From half a century's work the Meteorological Department has accumulated a great store of numerical data on rainfall, temperature, wind, cloud and humidity, and there are available corresponding data of crops in India. All this material invites examination for casual relationships, and the methods of examination have become well known. The meteorological divisions and sub-divisions of India, as hitherto used, are based on political or geographic limits, and will in many cases require remodelling for the purposes in view: the divisions of the year hitherto adopted are likely also to be found to have been artificial from the agricultural standpoint. These two features together will mean extensive rearrangement and recalculation of accumulated data.

7. On division (i), then, I should purpose that we recruit now a Statistical Expert, give him a staff of 3 or 4 young Indian mathematical graduates, and as many computing clerks as necessary, perhaps 12, and start him to work in earnest on the great bulk of data ready to hand. In considering whom we should engage to put into charge, I recognise that in addition to securing mathematical ability, it is essential to choose a man of imagination and critical faculty, and with such keenness on the "yield" of his work that progress may be rapid, and the fullest value for expenditure be secured. It is *not* enough to choose by brilliant mathematical ability only, and thus possibly invite a slow drifting of the whole project to a discreditable end. On imagination and keenness I should place $\frac{2}{3}$ of the value of the man in charge, the remaining $\frac{1}{3}$ lying in ability with statistical methods, which is freely available among mathematicians.

8. In intimate relation with the results of this statistical work will be their application to field agriculture, and this will certainly involve the improvement of meteorological headquarters in short-period and small-area forecasting. For the purposes of the present memorandum I have considered

the expenditure upon this matter of progress to be included in that of the statistical staff; and my estimate stands as follows:—

(i) Statistical scheme of work—

	Initially Rs. per mensem.	Average throughout service. Rs.
Officer-in-charge	2,000	2,000
4 junior mathematicians (400—50—600 —600—50—1,000—1,000—50—1,250 average 804½)	1,600	3,218
6 upper division clerks (120—8—160— 10—300 average 205-12-0)	720	1,234
6 lower division clerks (75—4—155 average 113)	450	678
Plus travelling allowance and office ex- penses put roughly at 10 per cent.	480	720
TOTAL	5,250	7,850

9. With regard to division (ii), it is perhaps the Agricultural Adviser to the Government of India, and his Provincial Colleagues, who are in the best position to advise: I have, however, counted that this department might be called upon to help in such questions as the following:—

- (a) Determination of “ effective rainfall ” with reference to the critical periods of growth of crops; it is known that the value of the same amount of rainfall is different at different times of the season, and the total rainfall weighted by these values would be the “ effective rainfall.”
- (b) Collection of further statistics to determine the most favourable conditions for the various crops and in various localities.
- (c) Study of the different elements required to secure a good harvest, e.g., amount of light, heat, humidity and rainfall and their time distribution.
- (d) Study of weather phases in relation to plant disease.
- (e) Determination of bio-climatic zones.
- (f) Determination of the effect of the many meteorological elements on growth and yield.
- (g) Study of effect of extremes of temperature, as met with in India, on plant growth.
- (h) Study of soil temperature distribution, and of soil humidity, in relation to growth.
- (i) Study of the nature and extent of damage by abnormal weather factors.

To deal with these matters staff will be required on the meteorological side, and for some of them physical apparatus will have to be devised and made. It is not possible, without further guidance than I have yet received as to the proposed agricultural programme of work on such problems, to suggest an estimate of cost with any value at the present time. There is no doubt, however, that Indian science graduates (physics) can be obtained fully capable, under headquarters advice, of carrying out all such work; and that headquarters officers can design as good apparatus for any ordinary physical work as could be done anywhere. The scale of pay of the former officers is indicated in the estimate above for junior mathematicians.

Oral Evidence.

1494. *The Chairman*: Mr. Field, you are Director General of Observatories?—Yes.

1495. You have put in for the Commission a very interesting memorandum on the work of your department, with special regard to agricultural matters?—Yes.

1496. I do not know whether you would care to make a statement supplementing what you have written, or whether you would rather proceed by way of question and answer?—I think I should prefer to answer questions first, and then make any suggestions which may arise.

1497. Your memorandum appears to be so complete that I have really very few questions to ask you. As I understand the position, in your view, you have now as a department come to a stage when the statistics patiently accumulated over a period of years amount to a sufficient basis on which you could proceed to useful deductions, provided you had the staff to do the work?—I think that is right.

1498. Will you tell us what you consider the most urgent service you could render to Indian agriculturists which is not at present being afforded them?—I think the first thing to do is to make use of the statistics we have by means of an officer who would be an expert in that matter, and who would correlate our statistics with those of agriculture as collected, say, in the Punjab and United Provinces. I have a file of notes on these points, and I believe the records for North-West India are much more accurate than they are, say, for Bengal in relation to field areas and the yield per acre over a long series of years. I do not know why that is, but I believe it is the case. What I should propose is that an officer who has a knowledge of India and of district work, and who is a mathematician and has these matters in mind, should take up the work of correlating these two things, which up to the present have had no work done on them at all; they have merely been collected. The results have probably been sticking up at us, but we have not taken advantage of them so far. I have suggested in paragraph 8 what staff would be necessary to do the work in a liberal manner, and I do not think the expense should be considered great. It has been suggested to me that this has been planned on rather too big a scale, but in the early stages it will be less expensive than I have shown (I have taken the average), and in any case the subject is very important. Two or three years' work at this expenditure would, in my view, give us a basis for judging whether to expand, contract or simply continue the work.

1499. You will probably agree with me that knowledge of an impending calamity would only be of advantage to the cultivator if it were possible for him to take some steps to ward it off or mitigate its effects?—That is so. We can at present forecast drought and good and bad monsoons to some extent; not in a very satisfactory manner, but we are getting better. Forecasts can be conveyed to the agriculturist quite independently of any steps on our part. Their preparation does not serve to connect agriculture and meteorology, because we deal with them independently of agriculture in the normal course of our work.

1500. Given an ideal system, how early in the year do you anticipate that you would be able to publish your monsoon forecasts?—The position at present is this. At the beginning of June data for our standard method of preparing forecasts have matured and we are able to form a judgment then. There are, however, several features much earlier in the year which are showing promise of becoming useful. When we develop these, and have sufficient experience to have confidence in them, we may be able to forecast in the middle of April.

1501. Let us assume that in any one year you prophesy a bad monsoon in April. What steps, do you suggest, are open to a cultivator to mitigate the

bad effects of such a bad monsoon, assuming he gets the information in April only?—I think he would probably curtail or postpone his sowings or his agricultural operations, but actually the precautions that were necessary would be for the Government to take, precautions against famine.

1502. Yes. You are, of course, familiar with the work of the Meteorological Bureau of the United States of America? Am I right in thinking that warnings as to early frost and hail are amongst the principal services which the Bureau in America gives the cultivators of that country?—Yes, I believe they are quite good on those two points. They certainly make very great claims in regard to them.

1503. And, of course, early frost and hail, though lasting in themselves only a short time, are dangerous to crops, and it is possible to take steps to mitigate their effects at short notice?—Against frost, certainly; as to hail, I think it is rather doubtful.

1504. I fancy there is a covering up of certain crops, but I speak under correction there. Is it, then, your view that an April forecast of a monsoon would in practice in India be useful only in so far as it enabled Government to come to an early estimate of the crop of the year and to take steps against famine?—I should think that is the present position. When we enter into more detail, with more work, that may be changed.

1505. What steps do you suggest are open to Government in April against a famine in the coming season which could not be effectively taken after the monsoon itself has obviously failed?—I am afraid that is a question on which I am not an authority.

1506. You will admit it is an important question in connection with your claim?—Yes.

1507. Are you in touch with the Agricultural Department?—To some extent. We have not had official dealings. I have followed their doings, and I have followed the correlation, so far as it has gone, of the two sets of data. Mr. S. M. Jacob, I.C.S., did a good deal of work years ago on that in the Punjab. He was very keen on this, but he has left India now. He used to get a great many statistics from me and show me his results, and I have certain notes as to them. I had him in mind as the only suitable man I know of to tackle this work and, in its initial stages, put it on a proper basis.

1508. Do you wish to lay any exhibits before the Commission?—I have some exhibits here.

1509. Do you wish to say anything about them?—If the members would care to look at them, I could explain anything afterwards.

1510. That would probably be a very convenient way of proceeding. How much do you think it would cost the Government of India to develop and sustain your plan in full?—I have suggested here that so far as the statistical work is concerned we should begin with an expenditure of about Rs. 5,000 a month. With regard to experimental work, it depends entirely on what the agricultural people call on us to do.

1511. Quite. I gather you would welcome closer touch with the Agricultural Department?—Yes, certainly.

1512. Are we to understand that for the sum you have mentioned you could begin work on the correlation of the data at present collected by the Department?—Yes.

1513. Would that be a rising annual item on the budget?—On page 196 of my memorandum I have put in the initial pay, because the men employed start on the lowest pay. Then I have given the average throughout the service, calculated in the ordinary way, which is about Rs. 7,800, and that throughout 20 years with that staff would be the average pay. It would end off slightly higher and begin slightly lower. I think this would be quite liberal enough in the early stages, until we knew where we were. After 3 years'

work of this kind, we should be in a very much stronger position to see what advantage we were getting out of it.

I need hardly tell you how greatly we appreciate the trouble you have taken to prepare this material for the Commission and lay it before us.

1514. *Mr. Calvert*: On this question of Jacob's attempt to correlate rain fall and so on, if I recollect aright, he was able to assign a definite value to each inch of rain that fell in the sowing period?—That was part of his work.

1515. And further a definite value to the rainfall month by month up to the maturity of the crop?—Yes.

1516. That would be of commercial value, would it not?—I think it would.

1517. But hardly of agricultural value?—Would you not call commercial value agricultural value? Would you separate them?

Not of value so much to the agriculturist as to the commercial man.

The Chairman.—The position being that the buyer is always best able to take advantage of early information on these matters.

Mr. Calvert.—Jacob's assumptions were perfectly correct; when there had been rainfall for a certain time people put down wheat, and the more rainfall the more wheat, so that one could practically foresee how many acres would be sown with wheat. He worked out the value of each inch of rainfall up to the maturity of the crop.

The Chairman.—That is to the advantage of the commercial man mainly, is it not?

1518. *Mr. Calvert*: Yes. With regard to the question of winter rains, which is very important in the Punjab, could you improve the value of your forecast if you had more information from countries west of Persia?—I do not think so. I have a diagram here which shows our winter forecast for rains in North-West India for the period November to March and the actual rainfall in that area. The forecast was made entirely from the strength of upper winds about 4 miles above Agra in September and October, well before the winter season to which it relates. (*The witness then showed the diagram,* which was for the years 1914 to date, to the Commission, and pointed out that so far as the accuracy of the forecasts was concerned it showed a correlation co-efficient of 0.91.*) We have made our forecast for this year, and I know what the probabilities are for the coming winter. In answer to your question, therefore, we can give a very close idea of the rainfall in North-West India provided that this short series of years does not let us down. In all these correlation matters one is very liable to be let down; we want a series of 30 years to be reasonably certain, and this is only for 12 years. However, it is very promising indeed. We sent this to the British Meteorological Office and they thought it unusually hopeful, but the series is short and we need the experience of 15 more years before we can have confidence in it. If it does not let us down as its history develops, it will be worth a tremendous amount of money.

1519. My next point is the Himalayan snowfall. Your information about snowfall is only guesswork, is it not?—No, we have reports from the Political Agents.

1520. I used to supply them. They are mainly guesswork, I think. If we knew the height of a mountain we could tell the height of the snow on it. The point of importance to the Punjab is the time when the snows will commence to melt and so fill the canals. Have you sufficient evidence on this point?—No, I do not think so. In regard to treatment of snowfall reports our method is necessarily somewhat rough. It is to take all the written reports, which are non-numerical and assign to each a value on the scale *minus* 3 through 0 to *plus* 3, as well as we can estimate them, multiply that number by a constant and add it to the rainfall, which is definitely numerical. That is our method all through with regard to snowfall, and we get our correlation co-efficients on that basis.

* For diagram see opposite page 203.

1521. One point on which I should like your opinion is this. I understand that the factors mainly affecting the monsoon in India are factors outside India?—On our present method of forecasting we use outside factors largely, yes.

1522. Does the question of afforestation or denudation of forests come in at all?—We are not able to use it, if it does come in.

1523. Would you entertain the opinion that denudation of forests had anything to do with rainfall?—Very little: the subject has been examined carefully.

1524. In India?—No: in India we do not do these things. We have to go to Germany or France for that. They have the money; we have none.

1525. In the provincial memoranda there are several references to a supposed decline in rainfall. Do you know if there is any evidence in support of that?—That is a matter that has been gone into. You will remember there was some scare about a change of climate in the closing years of the last century, and a memoir on the subject was written by our department, by Sir Gilbert Walker, which showed that rainfall had tended to increase to a maximum between 1892 and 1894 and sink to a minimum in 1899, since when it had slightly improved. That was written in 1908, but the years since 1908 have not suggested any coming disaster in the way of permanently diminished rainfall.

1526. There is a certain amount of evidence in favour of a periodic weak monsoon. The famine years run roughly in decades over a long time up to about 1900 and prices varied with them in decennial periods. Since 1900 we seem to have had no really bad monsoon?—I do not think that is true. We should require to have evidence over a very long period before we could say there was real periodicity. I rather question the assertion that years of scarcity have been in decades; there were 1877 and 1899; those are not decades apart.

1527. 1877, 1887, 1897?—We should want more data than those; 1887 was not a famine year.

1528. The inquiry into food prices in the last 60 years does suggest periodicity?—I do not know about food prices. I have a paper here on that subject by Mr. Jacob, but I have not gone into it sufficiently myself.

1529. *The Chairman*: Had you thought of putting that paper* in?—I should like to. I have several papers to put in that I have collected together. Curiously enough, most of them are written by Mr. Jacob; he is the only man who has paid any serious attention to these things; he was steeped in them. He was not directed to do this work; he did it on his own initiative.

1530. *Mr. Calvert*: I understand you have given considerable time and thought to the question of the higher organisation in the Government of India, including the position of your own Department?—Yes.

1531. Have you any views you would like to put before the Commission as to where your Department should come in in connection with other Scientific Departments?—I have thought about it, and it seems to me that Scientific Departments generally are handicapped because they are necessarily put under a Member of Council who in general has no scientific training. He is busy over other matter in which he is fully knowledgeable. Moreover, all the Scientific Departments are not together under one Member, so that one Scientific Department, which can perhaps represent its case more cogently than another, is liable to get more support than it should receive in relation to its needs, or *vice versa*. I merely suggest that if they were all under one Member, who had scientific knowledge, he would be able to apportion any funds that were available in a more suitable manner than is sometimes done now. In past years my Department has fared worst of all, but our present Member has been taking broad views in the interest of India, and has greatly improved our prospects of usefulness.

* Measurement of prices by Mr. S. M. Jacob read before the Sixth Indian Economic Conference, Lahore, 1923.

1532. Could you give us a more definite suggestion—something in a more concrete form?—I see that Dr. Clouston has suggested we might have another portfolio, a portfolio of science. That would deal with the point.

1533. Including Agriculture, Meteorology and Medicine?—I think he suggested a Ministry of Agriculture, with a Member in charge with a new portfolio. If we could have a Member in charge who had some scientific knowledge, rapid decisions could be come to on a sound basis, without the delay and the miscarriage of judgment which must necessarily occur frequently with superior control lacking special scientific training. In existing circumstances an administrative department is unable to judge a specialist proposal put up for sanction, and has to accept it, or not, according to power of meeting the expenditure involved. It must be exceedingly embarrassing for a non-scientific Honourable Member to have to settle important scientific programmes, while uncertain whether he is turning down a sound scheme, or admitting an unsound one: this consideration suggests that present Honourable Members would breathe more freely if they could have a scientific colleague on whom to unload all such awkward questions.

1534. Do you find the ordinary administrator sometimes experiences difficulty in understanding the language you use?—He does not show it.

1535. For instance, Jacob's papers are very difficult for a non-statistician to understand?—Yes, if they are going to try to understand his methods of deducing things, but I do not think that is necessary. The theoretical statistician has worked out his tools, and anyone can use them. We do not require a workman to be able to turn out tool-steel, but he must be able to use it. In many cases I cannot do the things myself, but I can use the methods because they have been standardised.

1536. Are not your monsoon forecasts also used in the epidemiological forecasts of Colonel Gill?—I believe he has been using them a good deal, yes.

1537. That opens up a further value for them?—Yes.

1538. *Professor Gangulee*: Would you agree that your department has done practically nothing up to the present of real value to the agriculturist?—We have not applied our information yet.

1539. You think you have accumulated a mass of relevant meteorological data which may be correlated with agricultural data?—Yes.

1540. Has Mr. Jacob's method been tested?—Yes; he is extremely well received in all statistical publications; his work is spoken of in the highest terms.

1541. His papers have been tested by the Royal Statistical Society?—Yes.

1542. Can you determine quantitatively the relation of different climatic features to crop production?—We can determine the quantitative data of meteorological events and if those are then correlated with the quantitative data of crops the result is quantitative.

1543. With the data you have in your possession, do you think you can determine optimum conditions of weather for agricultural operations?—We do not know the optimum conditions for agricultural operations because our attention has not been directed to the matter; there must be co-operation between the two departments before we can determine that; but I think it should be possible to do so with the actual data collected. We have innumerable data.

1544. Can you give any warning against floods?—Yes, we do a great deal in that direction. In fact, if we were given a budget which at all took into account our work against floods and cyclones, we should never have to ask for another anna.

1545. Given a Department for Agriculture and Meteorology, how best could you hope to provide the meteorological information so as to benefit the farmer? I am now referring to organisation. Given a scientific Agricultural and Meteorological Department or office where you have the information, how best can that information be made to reach the farmer?—I think that is hardly

a question to put to me; I am not an authority on things of that kind. I sit in Simla; I have no experience of district organisation.

1546. Have you thought out, in the scheme you have presented to us, the question of the broadcasting and distribution of meteorological data?—I have here copies of our various publications, which are distributed by post and telegram; beyond that I have nothing to suggest without further consideration.

1547. Have you thought out a definite line of co-operation with the Department of Agriculture?—Yes; it is what I have suggested here. I have suggested that we shall start immediately this correlation business, because we have all the material to work on; and then I suggest in the last paragraph on page 196 that with regard to physical work we start from the beginning with the advice of the agricultural people and we do what they ask us to do; for instance, the soil temperatures and soil humidities as we go down in the ground are at various times of the year important in different degrees; those things can be measured, and as far as I know they have not been measured in India except on a small scale, at Pusa, for instance. But it may be the case that work on that point is needed in various parts of the country in many centres, and we could put instruments into a standard form with a little thought; but it has not been done. That is merely a suggestion under my last paragraph, that we should get on to physical work.

1548. Then you believe we have in the provinces organisations which can be utilised for the purposes of distributing meteorological data and also collecting meteorological data?—But we do collect it; we have all the facilities for collecting meteorological data.

1549. Data with reference to agricultural crops, soil temperature, and that sort of thing?—Yes. With reference to agriculture we may have to modify our method of dealing with the data, but the data are the same. Instead of at 8 o'clock in the morning, perhaps we should have to observe three times a day at these special posts.

1550. You would utilise for such purpose our experimental stations at different parts of the Provinces?—If we are invited to co-operate with agricultural experimental stations, yes, or anywhere else.

1551. *Sir James MacKenna*: Do you telegraph to local Governments forecasts of exceptional weather conditions, such as the recent cyclone in Akyah?—Yes, we have a great number of officers to warn. I could not give the number off-hand, but it is something of the order of 2,000* who in different parts of India and Burma have to be warned of all disasters of that kind; and the number is steadily growing.

1552. I recollect in the old days you sent a daily telegram?—We send a daily telegram now at any time of the year.

1553. Under what department of the Government of India are you at present?—Industries and Labour.

1554. You would be more at home in Education, Health and Lands, would you not?—I do not think it makes much difference, so long as our recommendations are accepted.

1555. *The Raja of Parlakimedi*: Indian monsoons depend largely upon the barometric pressure India has for the time being, do they not?—The relationship of the barometric pressure here and in other parts of the world, yes.

1556. So therefore we do not depend upon the conditions outside India for our monsoons?—Yes, largely; the whole world is inter-connected in those matters. We cannot tell which are correlated effects and which are true causes, but we can use them all: we can observe pressure in South America and temperature elsewhere, and wind and rain, and we know their correlated value on the Indian monsoon. It is impossible to forecast the monsoon at present by dealing with India only. On the other hand, we are coming across some new facts very similar to the curve that I gave for the winter rains. For

* 2,000 was wrong: the present number of officers warned is 763, and the warnings issued last year amounted to 8,000.

instance, we have been working for 10 years in Bangalore with balloons, and we find that at about 6 or 7 kilometres above sea level at Bangalore in April there is a very strong correlation of the strength of winds through April at that height and the subsequent monsoon in the Peninsula. There is a correlation of about 0·8 as far as we have gone. There again, the series of years is much too short to say more than that it is a hopeful method; we want another 20 years, and then we shall be able to speak with some confidence.

1557. By what length of time could the occurrence of floods be foreseen?—Floods commonly result from a disturbance in the Bay becoming a storm and running overland up the Gangetic plain; for instance, as happened the other day at Jubbulpur. In that case we should know two or three days beforehand what course the storm was likely to follow; that it was likely to give heavy rain at Jubbulpur in three days' time, and roughly what amount of rain there would be.

1558. From what station was this foreseen?—From Simla.

1559. I suppose you can foresee it for any part of India?—Simla can foresee everything over India, yes. It depends upon the information we get by telegraph daily. Bombay would do equally well; any other station would do equally well if the complete meteorological information were received there instead of in Simla.

1560. How do you propose to popularise these meteorological forecasts with regard to agriculture throughout India?—I do not propose to do so at all; I want to get on with the work itself; to popularise them is outside my Province.

1561. You have some data which would be useful to agriculture; in order that those data may be of benefit to the country, what action would you advise the Government to take to popularise it?—This is a new question and would require consideration. In America there is no charge even for special messages of information to individuals, but in this country we have, in recent years, had instructions to charge for every thing done, and free distribution is practically a thing of the past. There is therefore no sign that Government wish as yet to popularise our data. For myself, my sole concern has been to extract an improved budget to do the work itself, but somewhat unsuccessfully up to recent times. Prospects are however brighter than they used to be, when budget extraction was like drawing teeth, a painful process on both sides.

1562. *Sir Henry Lawrence*: I think in answer to Mr. Calvert your reply was to the effect that there is no indication that there has been any serious decrease of rainfall in recent years?—Yes.

1563. Is that general, or might there have been a decrease of rainfall in certain areas?—I cannot say that certain areas are not feeling it. I was talking of India as a whole.

1564. Would your statistics indicate that in particular areas there had been a decrease, or is that work for a separate officer?—Yes, I think we could examine the point, but it is probable that any apparent change would not be found to have lasted from 1900 right up to present time; there is nothing to be feared as to a real change of climate.

1565. We hear statements made that wells have ceased to give water owing to the constant decrease in rainfall; you have no indication that that is true on any large scale?—No, I do not think so, and also I think that result would be complicated by effects of the water-table down below which are not known. I know that in our observatory in Agra the water-level, of which the log has been kept for many years, varies in an apparently erratic manner, which often shows little relationship with the rainfall of the season. It does not necessarily rise in the monsoon time; but also it may continue a monsoon rise into mid-winter.

1566. There are variations in the subterranean water which are not correlated to the rainfall of the year?—In that particular case it shows less connection than would have been expected.

1567. Now in certain parts of the world experiments have been made in control of rainfall; have any such experiments been made here?—No; control is impossible. I think that such control would only be claimed in America (and possibly Australia), and then only by private cranks as a means of filling their pockets. The rainfall is controlled there, according to the controllers, by an impressive apparatus which is carted about and erected on a farmer's land, but it must not be looked inside. The basis of business is that the farmer shall pay, say, \$1,000 per inch of rain in excess of the normal: if rainfall fails to reach the normal, no fee is paid and, with mutual condolences, the apparatus is dismantled and carted away. It is an ingenious application of the case "Heads, I win; tails, I don't lose."

1568. Do you suggest that these farmers actually do pay these sums in America?—Oh yes, according to the Press it is really done; I do not say it is common. These people can make a very fat living by just taking in one or two farmers a year; their apparatus is very elaborate-looking and impresses the credulous.

1569. Do they send up electricity into the clouds?—Not in the apparatus I am referring to. It is merely a thing that looks like a railway water-tank mounted on a big girder frame: then they stir up something inside. There is probably nothing inside, but they stir it. If the rain comes, it costs \$1,000 per inch of excess: if not, the operator probably says "I regret the failure, and must go as I have an engagement elsewhere: kindly provide me with introductions further west."

1570. You do not see any future hope of tapping the rain that passes over the Western Ghats, and giving us rain in the Deccan?—I am afraid there is no control.

1571. *Sir Ganga Ram*: Did I understand correctly what you said to the Chairman, that you will be able to say in April what kind of monsoon there is going to be?—Yes, I think so, later; it is a matter of many years. There is no question in my mind that we shall be able to do it in 50 years' time, and the degree of help that we are given by Government in the meantime will determine how much that 50 years' period can be shortened.

1572. And in June again whether the monsoon will continue in September and October?—Yes, we shall know all details in 50 years' time.

1573. You may be able to give us some fairly reliable figures?—I think our figures are fairly reliable now.

1574. The figure you gave to the Chairman was Rs. 5,000 a month; is that non-recurring?—No, that is recurring.

1575. Will there be some non-recurring expense for equipment and so on?—Not on this problem; this is not a problem of forecasting at all.

1576. By your forecast can you tell us the weather in America, because we are very much interested in learning whether the cotton crop in America has failed? Can you give us any indication of what sort of weather prevails in America, because whatever is learned in the papers is put in by speculators?—I do not know; I could not say about the American weather; but I know America is very much interested in Indian weather and I think for politico-economic reasons.

1577. And we also are interested in the American weather. Can you give us a reliable figure; the figures in the newspapers are put in by speculators?—I know they are; but figures that are published by the official American Weather Bureau can be trusted.

1578. You do not publish them?—We do not publish but we receive them.

1579. The weather conditions in America in reference to cotton?—We receive them continually.

1580. In the Punjab when there is no frost we get three pickings, but when there is frost we lose one picking. Is there any practical way of protecting our crops from frost?—But you do not have frosts in the Punjab, do you?*

1581. Oh yes, we get bad frosts about the 15th December?—But you do not get frosts which ruin the crop, do you?

1582. Oh yes, if we did not get frosts on the 15th December we should get an extra picking which would mean an increase of one-third in the value of our crop. Is there a practical remedy?—Yes, I think there would be; for instance, a smoke screen is commonly used in America to avoid very intense frosts when they know they are coming; we know when the temperature in the Punjab is likely to go down.

1583. Could you give us any detailed information as to the use of a smoke screen?—Yes, it has been done in America; a farmer receives a warning that there is likely to be a frost, he goes to windward of his ground and starts some smouldering fire which slowly spreads smoke over the ground up to a height of, perhaps, 6 ft., or, over his fruit trees, perhaps, 10 ft.

1584. You see, I tried tree cotton; but the tree cotton always comes into flower about December, with the result that I could get nothing from them and had to cut them down. I should like to have some practical remedy?—Well, I think that is a practical remedy. Whether it would pay or not to do it, I cannot say.

1585. Did your Department give any warning in 1917 when in the Punjab we got 17 inches of rain in 24 hours at places where the annual rainfall was only 9 inches?—I am afraid I was away then, so that I could not tell without reference.†

1586. Will you please make a note of that: in 1917 the rain in 24 hours was 17 inches whereas the average annual rainfall is only 9 inches; it ruined our cotton crop and we lost crores?—Yes, I will see.

1587. *Sir Thomas Middleton:* Sir Henry Lawrence has already referred to the failure of the water in certain areas. The attention of the Commission was drawn specifically to an area in Bombay in which the wells have been failing in the last 30 years. You said that from your information the absence of rainfall would not account for that failure?—I said that on my observations of a particular well one could not draw definite conclusions from that only.

1588. The point I wanted to make was this; I looked up the area and I see that in that particular area you seem to have about 10 observing stations?—Yes.

1589. I was wondering whether you consider that generally you are sufficiently supplied with rainfall stations?—I think that for our own purposes we are sufficiently supplied, but for agricultural purposes I doubt whether we are, for the following reason: if one takes the rainfall records of one rain gauge and correlates it with the rainfall records right through the monsoon of the next gauge, it does not come to anywhere near unity. It should come to 1·0, but it does not; it comes to perhaps ·7 or ·8; sometimes it will be more and

* The witness was speaking of air temperature not reaching the freezing point, while the questioner had in mind the freezing of plant tops by radiation. Examination of records for Lahore for the period 1916 to 1925 (10 years) shows that while a minimum thermometer laid on the grass, and therefore cooling mostly by radiation, recorded temperature below freezing on 461 occasions, there was only 1 night (21st December 1919) during which the actual air temperature at 4 feet height (the standard height for measurement) fell to the freezing point.

† On examining daily rainfall registers it is found that when a depression was passing through the Punjab in September 1917, the most conspicuous rainfall (i.e., the heaviest in proportion to the normal) over that area in one day was at Montgomery, when 8" was recorded against an annual normal of 10"

sometimes less. That means to say that one rainfall station is not really representative of an area of which one would have thought it was representative.

1590. I was comparing the distribution of your rainfall stations with the distribution of rainfall stations in Britain, for example, and noticing the enormously greater areas you have got to cover in the deductions you draw?—Yes.

1591. But generally speaking, you are satisfied that you have sufficient for your purposes?—I think so; we have got as many as we can work; we have something like 3,000. They are very badly represented in Sind, Baluchistan and Hyderabad State, but for our present purposes we are never handicapped.

1592. In reply to Sir James MacKenna, I think, you said you had about 2,000* correspondents?—I think we warn about 2,000 officers of various types for cyclones, floods, bores, heavy wind and all types of warning. These are exclusive of warnings to ships at sea by radio broadcasts.

1593. A warning list?—Yes, all types of warning.

1594. Then what is your system of forecasts in the monsoon?—Daily we issue a forecast and report which issue together as the Daily Weather Telegram; I should not say that the forecast was of any very great value, except to engineers and others specially interested in heavy rain.

1595. It goes to the Press and is distributed in that way?—Yes, and it is also sent by telegram to any subscriber of, I think it is, Rs. 12 or Rs. 10 a month; he gets a daily telegram like a Press telegram giving him all the information of the rain that has occurred and the rain that we expect to occur.

1596. Does that arrangement last for the monsoon period or throughout the year?—Throughout the year.

1597. The Rs. 12 a month covers it?—Yes. I think it is Rs. 10;† it is the Daily Weather Telegram. The Daily Weather Report itself costs only Rs. 3 a month, but that goes by post.

1598. *Sir Thomas Middleton*: Then you make two points in your memorandum. The first is that there is a large amount of information which has never been worked up?—Yes.

1599. And it is time, in your opinion, that it was worked up?—Yes.

1600. You submit here a specimen of a correlation. I have looked at many correlations, but I have never seen one of this kind of weather forecast that worked out at higher than .9?—Yes, but the series of years is short.

1601. In Britain we generally adopt 35 year-periods for weather, as you know?—Yes.

1602. This correction extends over about 12 years; it is an extraordinarily close correlation. And you indicate that if your records were worked out it is likely that you might get quite a number of similarly close correlations?—We could get correlations. They would vary, but in any case, even those pieces of information which lead to purely negative results represent work which has been done and which has got to be done some time. It does not necessarily lose pecuniary value because the results are negative.

1603. I quite follow that. Then your next point is that there has been no attempt in this country to correlate the study of weather and crops except the work of Mr. Jacob?—As far as I know that is all.

1604. And Mr. Jacob has worked on Mr. Hooker's method?—Yes. Hooker may not have been originally responsible for it, but he adopted it.

1605. Now you suggest that at certain stations in India, experimental farms and so on, there should be crop weather stations like those that have been recently established in England?—Yes.

* 2,000 was the number which had been estimated in error in earlier evidence; reference has shown it to be 763.

† The charge is Rs. 10 per mensem.

1606. Has anything at all in that direction been done yet?—I suppose Pusa observes the weather.

1607. What records does Pusa actually take, do you know?—I do not know; they have published various things about soil temperature and soil humidity and a good many publications of that kind which I have glanced through, and which are valuable to the public. I could not say what they are doing now; I believe they are continuing.

1608. I am surprised to hear that these records do not come to you automatically, anything in England of that description goes to the Meteorological Office?—I think they do, but I have such enormous piles of publications come to me that attention fails unless specially directed.

1609. I thought you said they had not reached you?—I do not know; it is quite likely that these things reach me but I do not know.

1610. Then from your personal knowledge you can only remember Pusa as a station that keeps pretty complete crop weather records?—I suppose that Indore is doing it now where the Howards are, but I do not think we get anything from them.

1611. *Dr. Hyder*: Do you think your system of rainfall registration is good, that is to say, that you go round and inspect and see that the gauges are correct in the districts —It is very difficult to say what accuracy there is, but it is probable that the inaccuracy remains more or less steady, so that though the records must contain errors, their value as comparative statements from year to year remains.

1612. But you think it is desirable that the Head of the department should occasionally go and see whether these instruments are properly kept?—These things are done by District Officers; there are 3,000 of them, and all the different States report yearly that a certain proportion of them has been inspected. It would be impossible for the officers of my Department or for me to inspect things of that kind, except at our own meteorological stations.

1613. I was going to ask you further about forecasting the weather. At present you do not have any stations of your own either at Mauritius or in the Seychelles or at Zanzibar: it is only by way of courtesy that you receive this information?—That is practically so.

1614. With regard to co-operation with ships, that also is simply by way of courtesy; if anyone wishes to oblige you, then the Captain of the ship sends the record from his log?—Yes, we have no compulsory powers at present.

1615. Do you think we could do anything of that kind with regard to the Peninsular and Oriental and British Indian Steam Navigation Company, if they were put into some definite relations with you to supply you with extracts from their records; they receive Government money as a subsidy?—Well, that could be done, but our method of dealing with it now is fairly satisfactory from the point of view of logs; we have clerks at Calcutta, Bombay, Madras, Rangoon and Karachi, and when ships come into port they go on board and copy the relevant data of the log on regular forms, and we plot them on maps and use them.

1616. I see in your report you want the services of a Marine Meteorologist?—Yes.

1617. That is necessary?—Yes.

1618. You do a good deal of work at present for the Air Service, do you not?—Yes, a good deal.

1619. Could you not ask for a slice from the heavy Military Budget?—I am afraid not; the Military Budget has the habit, somehow or other, of absorbing some of my budget. We agree that over the Quetta and Peshawar district we shall do the work in certain proportions. Perhaps an item of their work fails: I have to do it in some other way, and I have to pay for it in my budget at present. I am talking of small matters, not really worth mentioning at present, because the whole expense is small; but still I have been a little disappointed over the apportionment of cost.

1620. Every Finance Member here says that the budget of the Central Government and the budgets of the Provincial Governments are really in the nature of a gamble on the monsoon; you are the soothsayer, and I am surprised to hear they do not supply you with adequate funds, when they say that, in view of the fact that you have the duty of forecasting the weather and the probable prosperity. Does the Finance Member read your Report?—I could not say; I have not asked him.

1621. The survey of the upper air currents is a thing that has got to be done?—Yes, we are getting quite active on that; it is a most hopeful procedure.

1622. You know that in England they are engaged in a study of industrial cycles; I was wondering whether anything of that kind, particularly with regard to the periodicity of famines in India, had been done?—I do not think there is a periodicity of famines; I do not think there is any cyclical order in regard to that; but it is a thing that has been suggested over and over again for hundreds of years and received a great deal of attention. There is probably very little in it at any rate, in comparison with the more spasmodic changes of weather.

1623. But the statistical material in your possession has not been worked out to find whether there is such a periodicity?—I should say we have not wasted time on it in India. It has been very exhaustively worked out elsewhere for other countries, and if there is any periodicity, the amplitude of it is so small that it is swamped by other facts and has little economic value.

1624. Are you quite satisfied with the method of giving flood and storm warnings in the Bay of Bengal area?—I think we are fairly good. We are improving, and Government has recently helped us considerably, by giving us further staff to place as whole-time officers at Calcutta. We have two now, whereas two years ago we had only a half-time man.

1625. When India is (as it may be in the near future) linked up with Europe by means of aeroplanes, do you think there will be a greater demand for the services of your department?—Yes, very much greater. We shall have to spend a great deal more money when that becomes a serious proposition and gets going; when we have aeroplanes flying regularly from Bombay to Calcutta and Rangoon, and from Karachi to Allahabad, Calcutta and Rangoon, very serious precautions will have to be taken.

1626. Would you require stations at Aden and elsewhere in Arabia?—Yes; and there would have to be stations inland in India staffed by a comparatively expensive staff. Our present distribution of observation stations in India is staffed mostly by men who draw Rs. 15 a month to take observations and send telegrams.

1627. The subjects dealt with by your department are seismology and meteorology. Do you think the former should remain?—Yes.

1628. *The Chairman*: Do you wish to put in any other papers*?—I have here a paper I should like to put in; a paper by Jacob on forecasts of crop areas with curves, which he sent in many years ago to the Punjab Government. There is a note attached by Sir P. Fagan (at that time Financial Commissioner of the Punjab Government) in which he discusses the subject and the question of their taking up the work. They did not take it up; I do not know why.

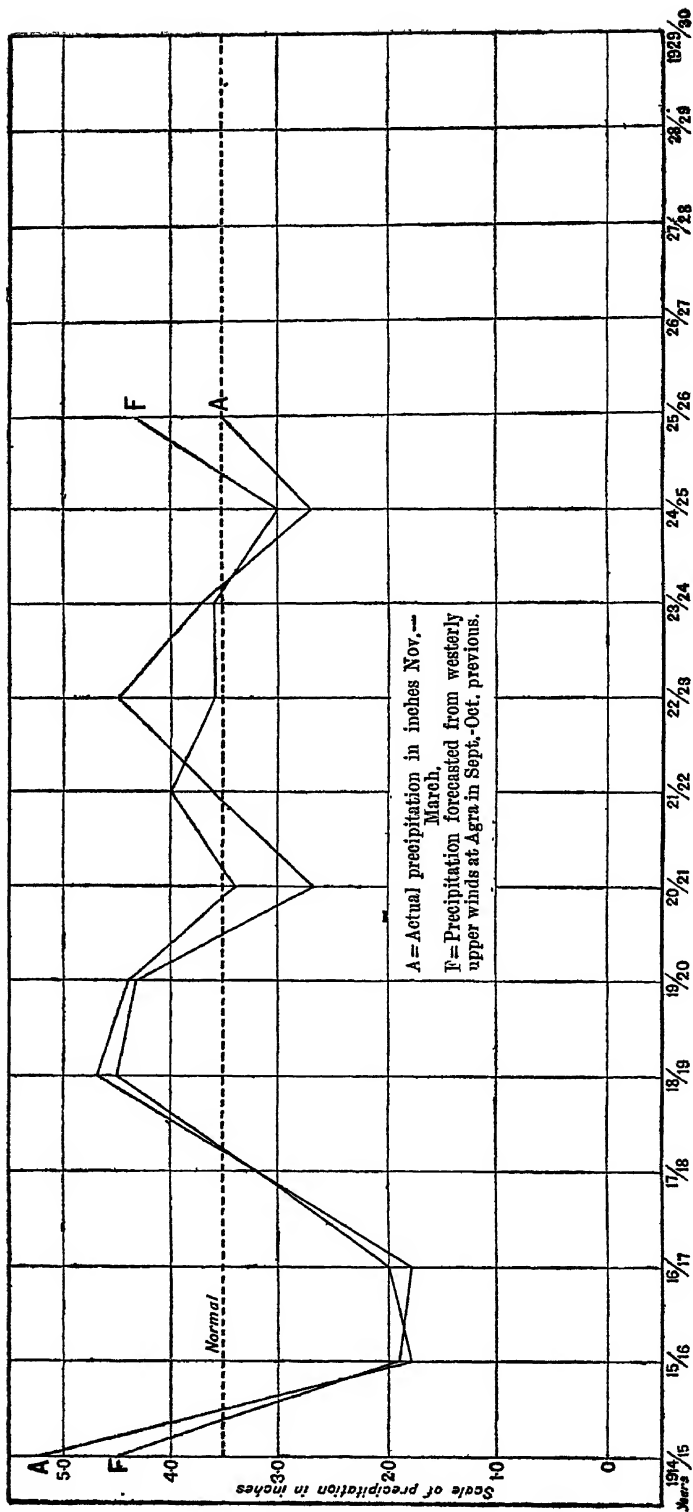
1629. Would you have any objection to the publication of the note in the Central Government Memorandum which you have prepared?—I have no objection.

(The witness withdrew.)

* Not printed.

APPENDIX.

WINTER PRECIPITATION (RAIN & SNOW) IN NORTHWEST INDIA



**[Mr. F. WARE, F.R.C.V.S., I.V.S., Officiating Director, Imperial
Institute of Veterinary Research, Muktesar.]**

Memorandum on the Imperial Institute of Veterinary Research, Muktesar.

Brief History of the Institute, its Organisation and Control.—In 1890, Dr. A. Lingard, M.B., was appointed as Imperial Bacteriologist at the Laboratory attached to the College of Science at Poona with the following instruction:—"to investigate diseases of domesticated animals in all Provinces in India and to ascertain, as far as possible, by biological research both in the laboratory and, when necessary, at the place of outbreak, the means for preventing and curing such diseases".

At first the Imperial Bacteriologist was under the administrative control of the Bombay Government, but in 1893 he was placed directly under the Inspector-General, Civil Veterinary Department, as it has been previously decided to move his laboratory from Poona. In 1895, therefore, the Imperial Bacteriological Laboratory was opened on its present site at Muktesar and the staff then consisted of the Imperial Bacteriologist, Assistant Bacteriologist, one Indian laboratory assistant, 3 clerks, one artist and some menials.

In 1898 the control of the laboratory was transferred to the Director-General, Indian Medical Service, but in 1901 it again passed to the Inspector-General, Civil Veterinary Department. Dr. Lingard retired in 1907 and Colonel (then Captain) J. D. E. Holmes, I.C.V.D., was appointed to relieve him as Imperial Bacteriologist. By this time a third Imperial Veterinary Officer and 3 European Laboratory Assistants had been sanctioned for the laboratory, and in 1909 a Physiological Chemist was added.

In 1912 following upon the abolition of the post of the Inspector-General, Civil Veterinary Department, the control of the laboratory was undertaken by the Agricultural Adviser with the Government of India, under whom it still remains.

In 1913 the post of Pathologist was created, and early in 1915 Colonel Holmes died suddenly at Bareilly. For some time the administration of the laboratory was carried on by the Assistant Bacteriologist until the arrival in October 1916 of Mr. (now Dr.) A. L. Sheather, B.Sc., M.R.C.V.S., who had been recruited in London. A year after Dr. Sheather's arrival his title was changed to Director and First Bacteriologist, and other alterations in the staff were the addition in 1919 of an Imperial post of Veterinary Officer and a provincial post of Veterinary Deputy Superintendent, and the abolition of the post of Physiological Chemist. Dr. Sheather proceeded on leave in April 1920 and failed to return, so that the post of Director was again held for sometime in an officiating capacity only, until the arrival in November 1921 of Mr. J. T. Edwards, B.Sc., M.R.C.V.S., who was also recruited directly from London. This officer remained in charge until 7th March 1926, when he proceeded on leave to England, and during his time the name of the laboratory was changed to its present title, and the Imperial posts were re-designated Director, first, second and third Veterinary Research Officers and Pathologist. At the time of writing, the posts of first and second Veterinary Research Officers have no occupants and the Government of India have recently sanctioned 4 new provincial posts to be designated Assistant Veterinary Research Officers two of which are also unfilled at present. Concurrently with the growth in the superior veterinary staff there has, of course, been a corresponding increase in the subordinate, clerical and inferior staffs, and the addition of such officers as Engineer, Medical Officer, etc. The list of Sections printed as Appendix* 1, if compared with the staff enumerated by Holmes in his "Description of the Imperial Bacteriological Laboratory, Muktesar; its Work and Products", 1913, will give a good idea of the great expansion

* Not printed.

which has taken place since that date, and yet it will be observed that pure research is represented by only 2 Sections, viz.:—Pathology, and the temporary Section of Tuberculosis, which is being financed partly by the Indian Research Fund Association. Sections representing such important subjects as Protozoology, Helminthology, Entomology, Bio-chemistry, etc., have not yet been formed.

Estate, Buildings, Cultivation, etc.—The land occupied by this Institute is situated partly at Muktesar and partly at Izatnagar, near Bareilly. The total area of the Muktesar Estate is now 3,453 acres, of which 2,724 acres is classed as Reserved Forest. The management of the Reserved Forest is regulated by a working plan prepared by the Forest Department, which is carried out by the Estate Section under the supervision of the Director, and is designed to supply the Institute with all the fuel and some of the hay and grass it requires. The amount of land now under cultivation at Muktesar is 206 acres, and this is gradually being increased in order to supplement and animal fodder supplies, the majority of which at present are obtained through contractors.

What is known as the station area comprises 523 acres, and includes the land on which all the buildings stand. A reference to Holmes' Memoir referred to above will show the large increase made in the number of buildings between 1895 and 1913, and this has gone on at a still greater rate in recent years, until to-day the number of buildings in Muktesar carried on the registers of the Public Works Department is 111. The buildings are under the charge of the Executive Engineer, Imperial Civil Works Division, Dehra Dun, and an Overseer of that Division is resident at Muktesar. The main laboratory building at Muktesar was destroyed by fire in 1899 and rebuilt in 1902 and a wing was added to it in 1910, but since that date there has been no addition, in spite of the great increases in staff, which have been and are still being sanctioned. In addition to the Director's office, which is located in it, this building has accommodation for only 3 research officers, a library, and a class room for 7 students. There is also available one out-laboratory at Muktesar for a research officer.

The Izatnagar Estate, sanction to purchase which was first obtained in 1899, comprises nearly 800 acres, of which 700 are under cultivation, so that, in all, the area under cultivation by this institute is over 900 acres. It is intended to use Izatnagar mostly as a branch laboratory for the production on economical lines of anti-rinderpest and anti-hæmorrhagic septicæmia sera, for which there is a very great demand, but development is greatly handicapped at present for want of accommodation. The only buildings erected so far are quarters for some of the staff, but it is proposed to commence the construction of laboratory buildings and cattle sheds during the current year.

Method of Recruitment of Imperial Staff.—The recruitment of the Imperial staff of this Institute has passed through three phases. Beginning with Dr. Lingard's appointment in 1890 the appointments appear to have been specially made up to 1898, when a Medical Officer was appointed as Assistant Bacteriologist and resigned the same year. From then until 1914, with the exception of the special post of Physiological Chemist, recruitment to fill vacancies was made entirely by selection from members of the Indian Civil Veterinary Department (now called Indian Veterinary Service) working in the Provinces, and during that period 7 such officers held appointments at this Institute. Of these, 2 died in service, 2 resigned early, 2 retired on a pension after approximately 20 years' service, and 1 is still in service. Between 1914 and March 1926, 13 Imperial Service Officers have held appointments at this Institute and only 2 of them were obtained from the provinces. Ten of the remainder were either recruited specially, or recruited to the regular service and posted direct to Muktesar. Of these 12 officers, 1 died in service, 8 have resigned, and 3 are still in service, but none of the latter has yet been 5 years in India. The remain-

ing officer was lent from the Royal Army Veterinary Corps for a short time in 1917. It is true that the period 1914-16 includes the War period, but it cannot be said that there has been any improvement in the stability of the staff of this Institute since the War ended.

The figures appear to indicate that the most satisfactory method of recruitment, with a few exceptions for highly specialised work, would be by long term agreement to a service and not to any particular post, thus making interchange easy between this Imperial Institute and the Provincial Departments.

Production of Sera and Vaccine.—Since the production of an anti-serum against rinderpest, the most serious cattle disease in this country, was first undertaken about 1896, the main routine work of this institute has always been the production of sera and vaccines for the diagnosis, prevention, and cure of disease in the domesticated animals, and this is the only place in India where standardised products for the above purposes are manufactured for sale. The growth in the demand for these products has been phenomenal, and the table below will show the enormous proportions that have now been reached. It will be readily understood that the work connected with their manufacture, testing, standardisation, distribution and accounting places, is at the present day, a very great strain on the administration. By far the largest customers for the products of this institute are the Provinces, and the latter are therefore keenly interested in its welfare in this respect. Other customers are the Military Department, Indian States, and such places as Persia, Iraq, Malay, Ceylon, etc.

Table.

Number of doses of sera and vaccines issued from the Imperial Institute of Veterinary Research.

No.	Name of product.	Number of doses issued.		
		1905-06.	1915-16.	1925-26.
1	Rinderpest serum	204,979	969,460	5,224,523
2	Anthrax serum	26,712	48,337	72,777
3	Hæmorrhagic Septicæmia serum	18,603	79,965	379,189
4	Mallein, ordinary	2,587	30,332	40,886
5	Hæmorrhagic Septicæmia vaccine . . . .	...	124,150	211,150
6	Blackquarter Vaccine (pillules) . . . .	...	20,257	21,500
7	Mallein for "I.D.P." test . . . .	...	112	24,100
8	Tuberculin, ordinary . . . .	...	434	3,888
9	Anti-streptococcic serum . . . .	...	17,132	22,949
10	Special Vaccines . . . .	...	205	250
11	Blackquarter serum . . . .	...	...	7,893
12	" Aggressin . . . .	...	...	36,756
13	Tuberculin, concentrated . . . .	...	...	13,325
14	Avian Tuberculin, ordinary . . . .	...	...	1,180
15	" concentrated . . . .	...	...	4,836
16	Triple Strangles Vaccine . . . .	...	...	345
17	Abortion Vaccine bovine . . . .	...	...	180
TOTAL .		252,881	1,290,384	6,064,627

Lines of Research and List of Publications.—The research work undertaken at this institute has naturally been, almost without exception, connected with disease in the domesticated animals as found in India, particularly with a view to providing efficient methods of prevention. At different times work of a more or less intensive nature has been carried out

at this institute on almost all the known disease conditions of Indian stock, of which the following is a list Rinderpest, Surra, Dourine, Rabies, Kūmri, Hæmorrhagic Septicæmia, Blackquarter, Anthrax, Foot and Mouth Disease, Tetanus, Strangles, Equine and Bovine Abortion, Tuberculosis, Johne's Disease, Pyroplasmosis, Coccidiosis, Parasitic Diseases, Bursati, Glanders, Epizootic Lymphangitis, Bovine Lymphangitis, Nasal Granuloma, etc. For further details a reference is invited to page 12 of Holmes' Memoir referred to above, and also to two notes, dated 27th May 1922, and 9th March 1925, prepared for the Government of India by Mr. Edwards, who refers at some length to the investigations which have been undertaken during recent years. Work on many of the conditions mentioned is still in progress, and it should be noted that in no single case in this imposing list can it be said that our knowledge is complete.

Advisory work and Co-operation with other Departments.—The departments with which this institute may be said to come most in contact are:—

- (a) Provincial Veterinary Departments.
- (b) Army Veterinary Service in India.
- (c) Agricultural Department in connection with the Imperial Dairy Herds at Pusa, Karnal and Bangalore.
- (d) Medical Department.

The intimate connection between this Institute and the Provincial Veterinary Departments in the matter of supplies of sera and vaccines has already been referred to. Apart from this, there is very little correspondence or connection between the two. Pieces of research work have been carried out at this institute at the instigation of Provincial Veterinary Departments, and occasionally advice is sought by them, but in nearly every case this can be traced to some personal arrangement. There is no other means of co-ordinating the work of this Institute and that of the Provinces, with the result that there is little co-operation. In at least one recent case there was distinct friction as a result of what a province considered intrusion by this Institute in the matter of investigating a disease. Most of the Provincial Veterinary Departments now have a laboratory of their own, but this should be no cause for friction. Rather, with proper co-ordination, as the number of laboratories increases in the Provinces so should the amount of work done in them and in this Institute increase. In many ways this Institute is ideally situated for research work, but in others it has distinct limitations, and these might be admirably filled by the provincial laboratories.

By far the greatest demand for advice and help comes from the Military Department, and there is at the moment a considerable amount of investigation into such diseases as Abortion, Tuberculosis, Johne's Disease, Strangles, etc., being undertaken by this institute in co-operation with Army Veterinary Officers in charge of Military Dairies, Remount Depôts, etc. There is also quite a large correspondence in smaller matters with Army Veterinary Officers who, probably because they have no similar institution of their own in this country, appear to look on this one as the natural place to which to apply for laboratory help. Although, therefore, this institute has usually been considered a Civil institution, it appears that the Military Department makes more use of it in the way of seeking advice, than the civil authorities do.

The connection between this Institute and the Imperial Dairy Herds is not a very close one. Serum simultaneous inoculations against rinderpest are periodically carried out in them by members of this institute, and occasionally they are made use of for other field experiments, but there is not the same close co-operation as seen in at least one of the Provinces, where the Veterinary Department is wholly responsible for the health of the animals belonging to the local Agricultural Department.

The connection between this Institute and the Medical Department has naturally not been so close since its control was removed from the Director-General, Indian Medical Service, but there is no doubt of the sympathy which exists between it and the Research Institutes concerned with what may be called Human Medicine, as opposed to Veterinary Medicine. An example is furnished by the present arrangement under which an officer lent by the Indian Research Fund Association is working at this institute on Tuberculosis, a disease which concerns both sections of Medicine.

Education and Training.—Since its inception, this institute has been looked upon as a place where post-graduate training could be obtained, both by members of the superior and subordinate veterinary staffs in the Provinces. When the use of an anti-serum against rinderpest first came into vogue it was the custom for Provinces to send up certain of their Veterinary Assistants for training in its application, but of recent years this has been undertaken mostly by the Provinces themselves. At the same time Imperial Officers in both the Civil and Military Departments have been in the habit of coming to this institute for 2 or 3 months at a time, in order to learn something of the latest developments in serum and vaccine therapy, and generally to brush themselves up in laboratory technique. A few years ago the present Director endeavoured to develop the institute as a teaching centre and instituted 3 kinds of courses, viz.:—2 short courses for Imperial and subordinate officers, and a 2 years' course for Provincial officers. The first of these was not well supported and the Government of India have recently ordered the short courses for subordinates to be discontinued, on the ground that this is a prerogative of the Provincial Veterinary Colleges. The 2 years' course for Provincial officers was attended by men, who have now returned to the Provinces, and it is not proposed, at the moment, to hold another such class. The object of this class was to train these men for the highest posts, and it is for the Provinces to say how far that object has been achieved. To an unprejudiced observer it appears that this institute is not in a position to give the all-round training necessary to fit a man for the highest posts in the department. It lacks teaching staff, accommodation, a museum, and clinical work—all most important considerations. As a place where a man can improve his knowledge of epizootiology and vaccine and serum therapy it is unrivalled, and, of course, it is admirably suited for a man who wishes to undertake, under expert direction, a piece of research work connected with the diseases of the domesticated animals, but under present conditions that is all that can be said. The following table shows the number of students who have attended courses at this institute during the last 10 years:—

Name of year.	Number of students from Provincial Governments and Indian States.			Number of students from Military Department.
	Subordinate officers.	Provincial officers.	Imperial officers.	
1916-17	1	...	...	1
1917-18	2	...	...	...
1918-19	2	...	...	2
1919-20	1	...	...	1
1920-21 . . . .	...	...	4	14
1921-22 . . . .	...	...	1	...
1922-23	2	6	1	1
1923-24	3	6	3	...
1924-25	13	1	2	1
1925-26	8	...	1	1

Finance.—For the sake of comparison a table showing the receipts and expenditure of this Institute during the last 10 years is given below:—

Financial year.	Expenditure.	Receipts.
	Rs.	Rs.
1916—17	2,65,754	1,62,321
1917—18	3,36,827	2,70,877
1918—19	4,35,173	3,44,809
1919—20	5,09,033	3,87,831
1920—21	6,59,544	3,85,302
1921—22	7,20,983	4,49,759
1922—23	7,60,178	5,09,376
1923—24	6,94,782	4,90,721
1924—25	7,32,030	6,62,821
1925—26	8,53,634	13,09,398

It will be observed that in most years there has been a slight excess in expenditure, but during the past year receipts have greatly exceeded expenditure. This may be attributed mostly to the fact that the year was an unhealthy one for cattle, particularly in the matter of rinderpest. The sale of anti-rinderpest serum alone provides this institute with about 77 per cent of revenue. The Inchcape Committee, which sat in 1922-23, decided that this institute should be self-supporting, but in doing this it appears to have entirely overlooked the necessity for increasing its usefulness as a pure Research Institute, in addition to a manufacturing centre for biological products. If the efforts of the institute in the latter direction are going to be crowned with success, it should lead to a gradual diminution in the amount of contagious disease amongst animals for which vaccines and sera are prepared, and at any time the demands for the main products of this institute may become so small that the balance of funds available for pure research will reach vanishing point. Such a position appears to be unique, for it is doubtful if there is any other Government research institution, which has to rely on the sale of its products for its funds for research. The amount allotted to research at the Provincial Veterinary Colleges is very small, so that the total expenditure of this country on pure veterinary research, i.e., apart from research connected with the manufacture of biological products, is almost negligible.

Quarantine arrangements for the inspection, etc., of animals Imported into India.

Under rule 47 of the Devolution Rules, as amended in the Home Department Notification No. F-447-23, dated the 19th November 1924, the establishment of live-stock quarantine stations is a central subject.

2. The importation of kine into India except through certain specified ports (viz., Calcutta, Bombay, Madras and Rangoon) is prohibited under the Government of India Notification No. 84, dated the 16th January 1920. This

notification, which was issued under section 3 (1) of the Live-Stock Importation Act, 1898 (IX of 1898), is still in operation. The object is to prevent the introduction of bovine tuberculosis into India with cattle imported from other countries. By the provisions of the Government of India Notifications Nos. 1491 and 1120, dated respectively, the 15th November 1923 and 14th August 1924, which were also issued under section 3 (1) of Act IX of 1898, horses, asses and mules cannot be landed at any port in the Bombay Presidency other than at the port of Bombay. This restriction, however, does not apply to horses, asses and mules imported for military purposes, being either the property of Government or imported on their behalf, or to authorised chargers of military officers. The prohibition was issued by the Government of India, at the instance of the Government of Bombay, with the object of preventing the introduction into India of infectious and contagious disorders. The notifications are still operative.

3. The embargo on the importation of animals at Karachi was placed on the ground that no facilities exist at that port for the proper inspection and identification of animals by qualified inspectors under the direct supervision of responsible veterinary officers. However, the question of throwing open the port of Karachi for the importation of horses from overseas has been taken up by the Government of Bombay.

4. In exercise of the powers conferred by section 4 of the Live-stock Importation Act, 1898 (IX of 1898), the Governments of Burma, Bombay, Madras and Bengal have issued certain rules to regulate the detention, inspection, etc., of animals imported into their territories from overseas.

Burma.—The rules apply to bulls, bullocks, buffaloes, goats and all other ruminating animals and swine. The Veterinary Officer of the Corporation of Rangoon is the Inspector of Live-stock for the purposes of the Act, and the rules thereunder. The quarantine stations are:—

- (1) The Corporation Slaughter-house, Kemmendine, Rangoon, in the case of swine; and
- (2) The Corporation Bullock depôt, Theinbyu, Rangoon, in the case of all other animals.

Bombay.—The rules apply to horses, asses and mules after their importation into the port of Bombay. The Government Veterinary Officer for the City and Harbour of Bombay is the Veterinary Officer for the purposes of the Act and the rules thereunder. It is not necessary for inspection to have a quarantine station in all cases. Animals not accompanied by certificates are sent to lazaretto for quarantine. Similar rules for the inspection, etc., of cattle have been framed, but as a quarantine station is essential to deal with cattle efficiently, the rules cannot be applied until such a station is provided.

Madras.—The Act is applied in respect of tuberculosis and to a bull, bullock, buffalo, cow, sheep, goat, or any other ruminating animal or a pig or the young of any of the aforesaid animals. The Madras Veterinary College has been declared as a quarantine station. The duties of the Veterinary Officer under the Act and the rules thereunder are performed by an officer subordinate to the Principal, Madras Veterinary College, or to the Superintendent, Civil Veterinary Department.

Bengal.—The rules apply to kine. The Principal, Bengal Veterinary College, performs the dual duties of the Veterinary Officer and the Quarantine Officer under the Act and the rules thereunder. The Bengal Veterinary College Hospital is used as the quarantine station.

In the case of horses, Glanders and Farcy, Epizootic Lymphangitis and Surra are dealt with under the Glanders and Farcy Act and the rules framed thereunder.

5. During 1924-25 the total number of horses and other kinds of living animals imported into India was 2,516 and 2,743, respectively. The share of the Provinces was as follows:—

	Horses.	Other kinds.
Bengal	313	1,077
Bombay	2,110	1,259
Madras	39	188
Burma	54	219
TOTAL	2,516	2,743

Out of the total number (5,259) 5,028 animals were from countries in the British Empire, the remaining (231) being from foreign countries.

Number of livestock in British India including Indian States as ascertained by a census held in 1924-25.

Oxen.				Buffaloes.			Sheep.	Goats.	Horses and ponies			Mules.	Donkeys.	Camels.
Bulls.	Bullocks.	Cows.	Young stock (calves).	Male buffaloes.	Cow buffaloes.	Young stock (buffalo calves).			Horses.	Mares.	Young stock (colts and fillies).			
5,986,327	47,556,386	40,258,697	33,330,438	5,576,494	15,152,417	11,469,176	23,793,361	34,851,182	738,780	724,075	246,520	70,250	1,481,924	633,365

Note.—The figures under Bengal and Baluchistan relate to 1919-20.

Note on the Civil Veterinary Department in India.

Introductory.

Presuming that the most important duty of the Civil Veterinary Department in India is the cure and prevention of disease among all classes of animals, and also that it is the general desire that India shall be provided with an efficient veterinary service, I find it difficult to submit answers to the Preliminary Questionnaire, framed by the Royal Commission on Agriculture in India, which will help the members of the Commission to frame recommendations to this end and at the same time deal adequately with the many difficulties with which this service, of which I have the honour to be a member, has to contend. The only questions which appear to deal with veterinary work are Nos. 1 (a) (ii) Veterinary Research, and 4 (a) and (c) Administration, and if I confine myself strictly to these two questions as drafted, I

shall by no means exhaust the problems which, in my opinion, need investigation, if India is to have the benefit of an efficient veterinary service.

Before proceeding further I wish it to be understood that I do not look upon the Civil Veterinary Department merely as an adjunct of the Agricultural Department. Agricultural operations cannot be carried on satisfactorily without an efficient veterinary service, but the Civil Veterinary Department does not depend on agriculture for its existence. Apart from agricultural animals the Civil Veterinary Department has to deal with other beasts of burden such as horses, camels and elephants, pet and sporting animals, and co-operate with the Medical Department in public health work, and in none of these activities is the agricultural department *per se* interested. It may also be added that, as far as the Imperial Institute of Veterinary Research at Muktesar is concerned, a considerable amount of investigation work is being carried on for the Military Department at the present time.

My proposals below therefore are based on the assumption that an efficient veterinary service is required in this country for all the different classes of work it may be called upon to perform, and if any improvement can be effected in it the rural population will benefit at the same time as other sections of the community. I propose to deal with the subject under the following heads:—Research, Education, Executive Work, and Administration.

I. Veterinary Research.—It may be said without hesitation that there is no organisation, little administration and most inadequate financing of veterinary research in this country. Dealing with the last point first I have shown in the Memorandum on the Imperial Institute of Veterinary Research, which I prepared for the Commission, that the difference between expenditure and receipts at this institute for the last 10 years is only Rs. 9,95,323, and presuming that the approximate cost of its products has been correctly arrived at, this may be taken as the amount of money spent by the Government of India on veterinary research during that period. The position in the Provinces is I believe worse, most of them allotting nothing for this subject. It is not possible to state the exact amount of money spent at Muktesar on veterinary research in recent years, as no distinction is drawn in the accounts between Production and Research work, but it may be stated quite definitely that owing to the small amount of scientific staff and the enormous demand on their time for the manufacture of its products, there has been little research work performed at this Institute compared with the amount waiting to be done. For reference in this respect I attempted to prepare a list of the veterinary problems still awaiting elucidation in this country, but it has attained such enormous proportions that I have decided not to include it for the present. Suffice it to say that there is work in this list, not only for Muktesar, but also for provincial research laboratories, even if every Province possessed one, for many years to come, and it seems important to impress both on the Government of India and on Local Governments the necessity for providing the staff and funds for carrying out properly organised research into veterinary subjects throughout India.

As regards finances it has been suggested that an Indian Veterinary Research Fund might be opened in order to induce private persons interested in this subject to contribute and so provide a regular supply of money, but it will probably be necessary for the different Governments to provide most of the funds for this work for many years to come, if any advance is to be made. Another suggestion is that the Rockefeller Foundation might be asked to allot funds for the advancement of veterinary science in this country, as they have recently done in America.

The question of organising and administering veterinary research is an important one, and it is obvious that if several research laboratories are to be set up, and funds are to be spent to the best advantage, some co-ordination of the work by a central veterinary authority will be required.

Another point connected with veterinary research, which is in an unsatisfactory state at the present time, is the lack of any suitable medium through

which the scientific work of the Civil Veterinary Department can be published. The Government of India insist, quite rightly, that the work of the members of this department shall be published as official publications, and the *Agricultural Journal* and *Memoirs of the Agricultural Research Institute* at Pusa have been selected for this purpose. These publications, however, are not generally found in the medical and veterinary libraries of the world, and there is no doubt that there is a disinclination on the part of several members of the service to publish the results of their work in anything but veterinary journals.

The position could easily be remedied by the institution by the Government of India of a series of veterinary memoirs and bulletins, edited by a senior Veterinary Officer assisted by an Advisory Staff.

II. Veterinary Education.—The question of educating the staff which will be required for the superior branches of this department in future is of the utmost importance in connection with any endeavours to form an efficient veterinary service for this country, and it is moreover one of the most difficult questions on which to obtain an unanimous opinion. It was discussed before the Islington Commission on the Public Services in India, whose report is dated 1915, and, although the Imperial Veterinary Service has been closed to recruitment since that date, its recommendations will serve as a basis for discussion at the present time. This Commission recommended that "classes teaching up to the highest (veterinary) standard should be established in India, and the passed students of these classes should constitute the normal field of recruitment for the Imperial branch of the department," and at the same time they recommended that, pending the creation of these higher classes, Indians should be recruited to the Imperial Service by promotion from the Provincial services, or by sending young men to England on State scholarships to obtain the Diploma of the Royal College of Veterinary Surgeons.

Presuming that it is now the general wish that India should be self-contained in the matter of providing the education necessary for all the officers recruited to its veterinary service in future, it seems desirable that this Commission should make further recommendations for the purpose of obtaining this result. The question of instituting a Central Veterinary College, teaching up to the highest standard, has been discussed for many years, notably at the Veterinary Conferences at Lahore and Calcutta in 1919 and 1923 respectively and by a Committee of Principals of Veterinary Colleges in Bombay in 1921, but no decision appears yet to have been arrived at. The disadvantage of such a scheme is undoubtedly the great expense that would be incurred in running a central college for the small number of students it would be likely to attract.

In my opinion, the alternative of recruiting to the new provincial services by promotion from the subordinate services offers a better chance of success, but it will be necessary in the first place to improve greatly the standard of teaching and examinations at most of the existing veterinary colleges, for the position at these at the present day is much like it was at the time of the Islington Commission, who state as follows:—

"But really efficient provincial services cannot be mainly recruited from persons of a relatively low standard of education who entered the service as subordinates, and the true line of advance will be to raise the level of the training in the Veterinary Colleges and at the same time to offer such prospects in the Department as will suffice to attract students of good educational qualifications to the Colleges."

The Punjab Veterinary College is now affiliated with the University and has a 4 years' course comparable with that of veterinary colleges in England, and if other Provincial Governments could be induced to make the same advance there would soon be in the Provinces an abundance of well-trained and experienced veterinary graduates, from whom specially promising men could be selected for post-graduate training to fit them for the highest posts

in the department. It might be necessary to send a man abroad for such post-graduate training in special cases, but when the staff at the Central Research Institute at Muktesar is complete, it would as a rule be available there.

Whichever of these schemes is adopted it should be noted that a considerable amount of responsibility will be thrown on the Government of India to provide the higher training required; and the necessity for an experienced Veterinary Officer to advise the Central Government in this matter will undoubtedly be felt.

III. *Executive Work*.—The executive work in the Provinces may be classed under three heads:—

- (a) Contagious disease.
- (b) Non-contagious disease.
- (c) Public Health.

The work falling under the two latter heads is essentially of a local and municipal nature, and the only remark I wish to make is that there is no uniformity in the manner in which it is carried out, and therefore the progress made varies considerably in the different Provinces. It is in connection with the contagious diseases of cattle that this department comes closest in contact with the agricultural community, and in fact it may be said that such disease may and does prove a very considerable limiting factor to the progress of agriculture in this country.

The two recognised methods of dealing with contagious disease are the use of biological products, and what are known as Veterinary Police measures. For the supply of the first the Central Research Institute at Muktesar is responsible, and except that progress is to some extent handicapped by lack of research staff, it may be said that as much as is possible is being done in this direction.

Veterinary Police measures, however, for the suppression of contagious disease in cattle, may be said to be almost non-existent in India. There is no all-India Act for this purpose and if there were, there is no agency with the Central Government, and even some of the Provinces do not possess a provincial staff, by which its provisions could be carried out. In Madras a Cattle Disease Act and a large provincial staff of veterinary subordinates exist, but contagious disease knows no boundaries, and much success therefore cannot be expected while no action is being taken in the bordering Provinces or Indian States. The case for a Central Veterinary Bureau of some description, in connection with this question of contagious disease alone, appears to be overwhelming, and I cannot do better than quote, in support of this statement, from paragraph 17 of Sir Reginald Craddock's Minute on certain of the conclusions of the Lee Commission on the Superior Civil Services in India, which sat in 1924. He says:—"Central Research Institutions like Pusa, Dehra Dun and Muktesar must be maintained and it would certainly be expedient for the Government of India with the provincialisation of the Veterinary Department once more to appoint a Veterinary Adviser, to advise both itself and, if need be, local Governments, in matters of cattle disease which may be of national or even international importance. There is scientific work to be done which knows no provincial boundaries, and it will be necessary for the Government of India to provide itself, especially in such departments as Agriculture and Veterinary, with a few officers recruited under all-India service conditions, whose services can be lent occasionally to particular Provinces at particular times and for particular purposes. The Provinces of India have not yet become separate States, and even were they to be so constituted in future, the Central Government could not be entirely unconcerned with matters of such vital importance to the country as a whole as to the progress of agriculture or veterinary science. Animal transport has not yet been entirely superseded for military purposes. The hide trade is not confined to any single Province, and foreign restrictions against India with regard to the export of hides would have very serious results."

IV. *Administration*.—It will be gathered from what has been stated under the previous headings that I am not satisfied with the services afforded by the Civil Veterinary Department to this country, and I consider the chief reason for this lies in the lack of proper organisation of the department, which prevents the different Governments from obtaining the best advice available.

The history of the abolition of the Inspector-General, Civil Veterinary Department, in 1912 and the arrangement by which the Agricultural Adviser to the Government of India took over charge of the Muktesar Laboratory and became the connecting link between the Civil Veterinary Department and the Government of India is, no doubt, well known, but the story of the Civil Veterinary Department in the Provinces has not received so much attention. In most of the Provinces the first officer to be appointed to the Civil Veterinary Department was a Superintendent who had charge of the executive work in the field, and later in some of the larger Provinces veterinary colleges were opened and to each of these another Veterinary Officer was appointed as Principal. For purposes of administration these officers were placed under a Civilian, who usually held the post of Director of Agriculture, of which subject he often had an intimate knowledge. The result naturally was that in most Provinces most attention was paid to the development and proper organisation of the Agricultural Department, but this Civilian officer did at least act as Head of the Veterinary Department and co-ordinating officer as the department expanded. About 10 years ago, when it became the rule for members of the Agricultural Department to be appointed as Directors of Agriculture, it was decided in most Provinces that it was no longer desirable to keep the Civil Veterinary Department under the Director of Agriculture, so it was placed directly under Government. The point I wish to emphasise, however, is that before doing this no attempt was made to improve the superior organisation of the department, or to bring the officers in charge of the different branches of the work under one departmental head, as is the case in all other departments in India, but they were placed individually under Government.

In my view such an arrangement cannot be too strongly condemned. It leads to continual friction, with the result that no progress is made, and this state of affairs is still further aggravated by the great discontent which prevails amongst the senior members of the service, owing to the absence of any administrative posts to which they can aspire. I would therefore urge most emphatically that, if the Provinces desire an efficient Veterinary Service, the first essential is to place its organisation on a sound basis, and it follows that, if for a subject like contagious disease, India is to be treated as a whole, the organisation in each Province should be more or less the same. Each Province should possess a recognised veterinary head, who would be responsible to his local Government for all the different phases of veterinary work, *i.e.*, executive, educational, research, and breeding operations where these are carried out by the Veterinary Department, and, with advice that should be forthcoming from the Central Government, he would organise his department on those lines which have proved most effective elsewhere.

In support of my plea for an administrative head in each Province I wish again to quote Sir Reginald Craddock, who in paragraph 34 of his Minute on the Emoluments of the Superior Staff of the Civil Veterinary Department in India, printed in the Lee Commission Report, says:—"There is no similar head of department in the Indian Veterinary Service, but a senior officer called the Veterinary Adviser to the local Government is given an allowance of Rs. 150 a month. (This allowance is cancelled when the officer reaches Selection Grade.) There is really no prize appointment in this service at all. It is impossible for a Veterinary Superintendent holding one of several circles to keep proper supervision over the other circles in addition to managing his own as a sort of *primus inter pares*."

"Veterinary" being a transferred subject it is admittedly difficult to make provision for the proper co-ordination of the work in the different Provinces and to define exactly what the future relationship between the Central and Local Governments in this subject should be, but I trust that I have been

able to show that some recommendations on this question are called for, and in my view the solution lies in the reorganisation of the Central Research Institute at Muktesar on the lines of the Bureau of Animal Industry in America.

The present arrangements for running Muktesar have definitely failed, and I would advocate the immediate creation of a post of Veterinary Adviser with the Government of India, with headquarters at Muktesar, whose first duty would be the very onerous one of administering the Research Institute. The staff of the Institute should be expanded so as to enable it to undertake any form of veterinary research, either alone or in conjunction with the Provinces, to provide post-graduate courses of a high standard, to help the Provinces, if required, in the suppression of contagious disease, and to form an editorial council for the publication of scientific veterinary papers.

The Veterinary Adviser with the Government of India would, of course, be referred to by that Government in all matters relating to civil veterinary work in India, and, being in a position to tour, his services would be available to the Provinces when required. He would also be in a position to compile an annual review of civil veterinary operations in India, at present not obtainable, and would act as Liaison Officer between his own and kindred departments working under the Central Government.

Oral Evidence.

1630. *The Chairman:* Mr. Ware, you are Officiating Director of the Central Institute of Veterinary Research at Muktesar?—Yes.

1631. You have been good enough to submit a note of your evidence, which my colleagues and I have had an opportunity of reading, and your Department has also provided the Commission with various memoranda dealing with different branches of the work of your service?—I have not seen those memoranda.

1632. Not the memorandum dealing with the Central Institute?—Yes; that is my own.

1633. The memorandum on the arrangements for the inspection of animals imported into India: have you seen that?—No.

1634. You are prepared to answer questions, I take it, on such subjects, though not, of course, on the memoranda themselves?—Yes.

1635. We are greatly obliged to you for what you have prepared for us. Do you wish to make any statement before we ask you a few questions?—No.

1636. Do you think the present arrangement, according to which the Veterinary Service is subordinate to the Agricultural Department, is a sound one?—I do not.

1637. Would you like to develop that a little?—It is a very difficult subject to speak about, because it has been the cause of a great amount of heart-burning.

1638. You may address the Commission *in camera* if you wish to do so?—I do not mind what I say being published, but it might perhaps hurt the feelings of the Agricultural Department; that is the only point. Ever since 1912 we have been subordinate to the Agricultural Adviser to the Government of India, and ever since we have been striving to get away. We are, of course, very good friends with the officers personally; a very large number of my friends are in the Agricultural Department.

1639. It is a question of principle and not of personalities?—Entirely. I have very strong feelings on the subject of (to use ordinary language) "running my own show," and I think in the Provinces the feeling is the same. I see no reason why Muktesar should not be controlled by a very senior veterinary officer; in fact, I see every reason why it should.

1640. Would you like at this stage to give one or two practical and administrative reasons why you think the public interest would be better served (for I imagine that is your view) if the step which you advocate were taken?—My idea is that if Muktesar were placed under a senior veterinary officer he would also act as Veterinary Adviser to the Government of India in civil veterinary matters. In the last paragraph of my note I refer to some of the duties such an officer would perform, and in addition to that it would be of very great advantage for the staff. Our veterinary staff throughout India is at the present time very discontented, and the men feel that in some ways their interests are apt to be disregarded 3 or 4 years ago what is known as the "Burma case" arose, when a Veterinary Adviser was required in Burma. Three or four of us in India were willing to go, and could have got permission from the Government to go, but the Imperial Veterinary Service men should be made contented if possible, because while all this discontent is prevailing it means inefficient work.

1641. I observe you attach very great importance to adequate co-ordination of work between the different Provinces?—I certainly do, if it can be effected. I realise, of course, how very difficult it is at the present time, but I feel quite certain that if there were a Veterinary Adviser with the Government of India the position could be greatly improved. I have been touring India to some extent myself in the last two or three months, and I am convinced

that if I had been doing so in the capacity of Veterinary Adviser with the Government of India I could have got certain things done. That, however, has not been possible since 1912.

1642. You express that view quite apart from your view as to the need of correlation in those subjects obviously of Imperial importance, such as contagious diseases and so on?—Yes.

1643. If you could have your way both as regards the Imperial Service and the Provincial Services, and obtain a complete divorce from the Agricultural Department, what field of work would you place under the Civil Veterinary Services?—In the first place, as I have stated in my note, I look on our primary duty here as the cure and prevention of disease amongst all classes of animals; anything else, in my view, is subsidiary. I have been out here now nearly 19 years, and I have always felt that up to the present we have not really touched the fringe of disease amongst animals in India, and until we do a great deal more in that matter I think such questions as animal husbandry, cattle-breeding and so on are really taking us away from our legitimate duties, which are not being performed, as they should be, at present owing to lack of staff.

1644. In your ideal system, would you allocate the improvement of the breeds of cattle in India to the Agricultural Department or the Veterinary Department?—I would allocate it to an entirely separate staff, which could be controlled by either department; either is capable of doing it. On the whole, I would lean towards the Veterinary Department, but it requires a separate staff.

1645. Its control is mainly an administrative question?—Yes.

1646. One more question on this matter of improving the breeds of cattle. I take it your view is that some officer of Government should be definitely responsible for the improvement in the breeds of cattle in India; is that your view?—Yes.

1647. I suppose you do not contemplate a special Imperial Service of that kind?—At present there is an Imperial Dairy Expert, whose Department does deal with cattle-breeding to some extent.

1648. But under your ideal system you would have an Imperial Officer dealing in the main with the improvement of the breeds of animals?—I do not want to say anything to detract from the work of the Imperial Dairy Expert, but I think it is a provincial subject more than an Imperial one.

1649. I do not think it is a question of detracting; we want your views as to what you think is the ideal system?—Quite so.

1650. You are definitely of opinion that departments of that nature could as well be controlled by the Agricultural Department as by the Veterinary?—It is a very moot point. In one Province it is under the Veterinary Department and it is in that Province that the greatest success has been obtained.

1651. The Punjab?—The Punjab. If we are to take that as an example, I should say it should be controlled by the Veterinary Department. It has certainly been a greater success there than in any other Province, as far as I know.

1652. Do you think there is sufficient touch between the Civil Veterinary Services and the Agricultural Services in the Provinces?—I think there is. I can only speak for Madras in any detail. I have spent nearly all my service in Madras, and it so happens we have not been subordinate to the Director of Agriculture there for many years; and either in spite of that or because of it there has been very close co-ordination between the two departments. There has never been any friction.

1653. I observe from what you say on page 220 that you are not too well satisfied with the manner in which the Provincial Departments are organised?—I am not.

1654. You say on the same page “no attempt was made to improve the superior organisation of the department, or to bring the officers in charge of the different branches of the work under one departmental head, as is the case

in all other departments in India?"—I was referring particularly there to those Provinces where we have got veterinary colleges. When we were separated from the Directors of Agriculture, instead of all veterinary work being placed under one departmental head, as I think should have been done, the Principal of the Veterinary College and the Superintendent of the Province (as he was then called) were simply placed individually under Government and each of them corresponded with Government. I know that has led to a great deal of friction in some Provinces.

1655. *Sir Henry Lawrence*: Friction between those officers?—Yes.

1656. *The Chairman*: Is that friction going on to-day?—It is still going on in some Provinces where a departmental head has not been appointed. In Madras, where a departmental head has now been appointed, I do not think there is any friction whatsoever.

1657. Have you yourself taken an active interest in cattle-breeding in India?—I am afraid I have never served in a Province where the veterinary people were in charge of cattle-breeding operations, or only in my first year of service.

1658. There is something in the nature of a breeding station at Muktesar, is not there?—No.

1659. I thought you had a herd you were improving?—We have a dairy herd, but it is for the supply of milk, not the improvement of cattle.

1660. I should have thought both might be achieved by one and the same herd, but it is a fact that no experiments have been carried out in the improvement of breeds at Muktesar?—That is a fact.

1661. My memory was at fault. Now I want to turn to page 221, where you say, "The present arrangements for running Muktesar have definitely failed." Do you mean they have failed to the extent of the research work not being satisfactory?—No. I should say it is in research that most success has been attained. It is in the matter of administration, and recently in the case of a very large field experiment.

1662. What are you thinking of?—I am thinking of Bangalore.

1663. How about the financing of the Muktesar Institute? I see you are expected to pay your way by the sale of sera?—Yes.

1664. Is that to say that the whole cost of the Muktesar Institute is expected to be defrayed by the sale of sera?—I understand it to be so, yes.

1665. Do you think it a sound principle that sera should be sold at a profit, or do you think that these prophylactic substances should be provided to the public at the lowest possible charge?—My own view of the matter, which I have recently placed before Government, is that our production work at Muktesar should be self-supporting. As all these products are manufactured at a very low price, we can make that part of the budget self-supporting, without charging any more than a few annas a dose.

1666. I said "paid for by the public," but I think it is only indirectly, through the Provincial Governments, that the members of the public pay?—I think it varies in different Provinces. In Madras, for instance, the entire cost of sera is borne by Government. In Bengal and the United Provinces it is borne by Local Boards, and I think in Bihar and Orissa the ordinary private person has to pay, but I am not sure of that.

1667. You say the sale of the sera should be expected to pay for the productive part alone?—For its own production, yes.

1668. If that were all, it would make an important difference in the price of the serum?—I am afraid I cannot tell you, because as far as I know up to the present all our charges at Muktesar have been borne on one budget and there has never been any separation between our production and research expenses. I am going into the question at the moment, but it is impossible at present to say how much these different products are costing and how much is being spent on what may be called pure research.

1669. For the purposes of your budget, you would take it that production begins at the moment when you sell the sera on a large scale to Governments

or the public; i.e., if you were engaged on a particular line of research to produce a particular serum you would not add the cost of the preliminary research to the cost of producing the serum?—Quite. At a definite point there is a break and it could then be handed over to our production section.

1670. Do you think the cost of sera controls the amount used?—It does in some Provinces, I understand. In the United Provinces where rinderpest has been very bad recently, I believe they would have used a lot more serum if money had been available. In my own Province of Madras, on the other hand, the price has not been the controlling factor. I have always got as much money as I required for the purpose.

1671. You said just now that in your view the problem as a whole had only been scratched so far?—Yes.

1672. Can you give the Commission, so far as rinderpest is concerned, what proportion of the total cattle population of British India has been immunised?—Before answering that question I ought to explain that in the immunisation of cattle against rinderpest we use two processes. Until a few years ago there was only one process, which conferred immunity for 9 days only. It is only recently we have used the simultaneous method of inoculation, which confers a permanent immunity.

1673. Just as the disease itself does?—Yes. The number of animals (outside Government animals) immunised by that method is infinitesimal.

1674. Is it a dangerous method?—In about 0·05 per cent of cases. The number is very small indeed; but there is always a chance, of course, that the most valuable animal in the herd to be immunised is the one that dies. It often happens that it is so, and one has to explain that risk.

1675. Is there hope, by further research, of reducing the mortality?—I think so. The mortality is not from rinderpest alone, but from other diseases like pyroplasmosis and coccidiosis; into which more research is needed in this country.

1676. Do you mean that animals suffering from those diseases die when you apply the serum?—They very often get pyroplasmosis at the same time as they get the rinderpest virus, and they really die from a combination of the two diseases.

1677. So that in administering the live culture you cannot be certain that you are administering the pure culture?—At the present time we cannot, no; the live culture, of course, is always taken from another animal; it is not an artificial culture.

1678. Could it not be?—It cannot be at present, our researches have not got as far as that yet; the rinderpest virus cannot be cultivated artificially.

1679. In the case of an organism which could be cultivated artificially, there is no reason why you should not use the attenuated live organism from stock, is there? When I say from stock, I mean from the culture?—There is no reason in the ordinary case, no; of course, that is usually done.

1680. In the serum-simultaneous method?—In rinderpest it is not.

1681. Rinderpest is the only disease which so far has been dealt with by the serum-simultaneous method, is it?—No, it is not the only disease.

1682. What other diseases are there?—For instance, hæmorrhagic septicaemia is sometimes dealt with in that way. There we are using an artificial culture, an absolutely pure culture, and serum at the same time.

1683. In the case of hæmorrhagic septicaemia do you find the mortality is lower than with the rinderpest inoculation?—Yes, it is much safer I think.

1684. Because you can guarantee that it is pure?—Yes, I think that is probably the reason.

1685. Who invented the serum-simultaneous method with culture and serum?—I cannot tell you who invented it; it has been in vogue for different diseases for a large number of years now, both in human and in veterinary practice as far as I know.

1686. Is simultaneous inoculation against rinderpest expensive?—It is usually more expensive than serum alone because it requires a larger dose of serum. An animal which would be given only 15 or 20 c.c. in serum-alone inoculation would probably receive 50 or 60 c.c., and possibly more, in simultaneous inoculation. But then, of course, he only receives that dose of serum once, whereas if he is getting serum-alone, he may be inoculated 4 or 5 times until the outbreak of the disease disappears; so that in the end it may not cost any more.

1687. How much does it cost per animal by the simultaneous method?—Rinderpest serum is sold at the rate of As. 3 per 5 c.c. It is very difficult to fix an average dose, because it varies tremendously according to the size of the animal and the breed; but perhaps one could take an average dose at about 80 c.c. At the present moment we are not making any charge for rinderpest virus; it is distributed free, but if it becomes a very popular practice, we should I think have to make a charge, because it throws a good deal of expense on our budget. It has all to be despatched by post.

1688. Do you think that under Indian conditions it is conceivable that by some such method as the simultaneous method an important proportion of the cattle population might be immunised?—I think it is quite conceivable. It would certainly take a very large number of years before any such action really had any effect because of the enormous number of animals in the country. It is very difficult, of course, at the present time to induce everybody to have their animals inoculated in the villages. We can always get a certain proportion done, but it is very difficult to get them all done.

1689. If you could bring the mortality still lower, would it be possible, do you think, to work out a system of insurance by a slightly higher charge per animal immunised?—In Madras just before I left we had actually started two or three cattle insurance societies. One of the rules was that these animals were to be protected against rinderpest if the Veterinary Department considered it necessary; but I am unable to say what result has been attained, because I left soon after that. It seems to me it is quite a practical proposition, but I understand these societies have failed in other Provinces.

1690. Do you think it is prejudice, or fear of economic loss, that disinclines the cultivator to subject his animal to these protective measures?—I think it is mainly superstition.

1691. In districts where the older method was applied and where there was ocular demonstration of its value, was that prejudice lessened by the experience?—Yes, it was. I am thinking particularly of outbreaks of this other disease, hæmorrhagic septicaemia; I know several instances in which after using our hæmorrhagic septicaemia serum we had very large demands for inoculation; but I am afraid that is not always the case in dealing with rinderpest. Rinderpest is not so easily controlled by serum as hæmorrhagic septicaemia is.

1692. You have to be on the ground very quickly to be in time, by any method other than the simultaneous method, in the case of rinderpest?—No, that is not the case, because rinderpest is a disease which often hangs about a village for some months. Our great difficulty in dealing with rinderpest by this serum-alone method is that it takes so long to go through a village. We cannot get all the animals inoculated the first time; a certain number, about 50 per cent, as a rule, are not brought up the first time for inoculation. We inoculate the other 50 per cent; these animals are only immune for 9 days, and our inoculators pass on to another village. During that 9 days the disease has been going on in the 50 per cent. uninoculated. At the end of that time it comes back into the inoculated animals, and our serum then comes in for a certain amount of criticism; the ordinary ryot not understanding that it only confers immunity for 9 days. I have tried myself many times; it is extraordinarily difficult to induce the ryot to allow his animals to undergo another inoculation. You do it once with a certain amount of ease, but you cannot get it done the second time. I cannot explain the reason why. He thinks once ought to be sufficient for any number of months.

1693. Twice is more than he can bear?—Well, he will not take them off the plough; I think that is possibly the explanation; it means a day's rest, of course.

1694. I think the whole Commission has read with great interest section II of your memorandum. On page 218 you say, "The disadvantage of such a scheme is undoubtedly the great expense that would be incurred in running a central college for the small number of students it would be likely to attract." Is there no hope that it might be attractive to students if the teaching were sufficiently good?—The annual recruitment figures for the whole of the Superior Veterinary Services in India, I believe, have been worked out to be about 2 or 3. It would attract a certain number of private students and some from the Indian States no doubt, but I think it is very unlikely that any class at present would run into double figures.

1695. Are there many persons in private veterinary practice in India?—Very few indeed, except in the towns of Bombay and Calcutta. I only know of one private practitioner in the whole of Madras City.

1696. If the question of animal diseases in India is going to be tackled at any time on a sufficient scale to give any hope of substantial mitigation of the trouble, do you think it would be necessary to have a very important recruitment to the services, very substantial additions to the services?—I would not like to say a very substantial addition.

1697. For instance, how are you going to get your sera administered; who is going actually to give the dose?—All inoculation work now is carried out by the Veterinary Assistants; they of course are only subordinates who go through a not very advanced course. I was not thinking of them when I talked of a central college.

1698. I recollect that point was made clear in the first memorandum. So that it would only be for the control of that work that additional officers would be required?—Yes, and for that reason I do not think the recruitment would be very substantial, at any rate, in the near future.

1699. Do you think the quarantine arrangements for the inspection and control of animals imported into India are satisfactory?—I am afraid I have no information on that subject at all, except in so far as the inspection of cattle for tuberculosis at Madras is concerned.

1700. Have you had any experience of the control of diseased animals as between Province and Province?—The only experience I have had has been of a negative kind; there is no system of preventing animals, even if they are diseased, moving from one Province to another.

1701. Still less when they are being moved from point to point within a Province?—Except in the case of Madras. Madras has got a Cattle Disease Act; it is a very old Act and is badly in need of revision, but it is occasionally applied in small areas. Under that Act we insist on owners reporting disease, and we can insist on segregation of animals diseased and in contact, the disposal of diseased carcasses, and so forth. Compulsory inoculation is also possible under that Act. But, as I say, up to the present we have only applied it in small areas like the hill areas where, if rinderpest does get a footing, it plays tremendous havoc. The animals are very susceptible, and it is very important to try and keep it out. It is very difficult to enforce the provisions of the Act in the ordinary villages in the plain.

1702. Can you tell the Commission anything about veterinary conditions in the Indian States?—I am afraid very little; I know a certain number of the Indian States do have a very small Veterinary Department. Mysore has a Veterinary Department of considerable size. I do not think any other of the Indian States, except possibly Hyderabad, have such a big one.

1703. Are there any appointments going in the Indian States?—In Mysore there is one quite well-paid appointment, but I think that is the only really well-paid appointment in the whole of the State.

1704. So that the fact is that there are very very few appointments in any one year in India open to a veterinary officer?—Very few.

1705. *Dr. Hyder*: You have just said that your inoculation gives immunity for 9 days; suppose the cultivator gave you another opportunity, for how many days could you give his cattle immunity?—9 days every time in the case of anti-rinderpest serum. In fact all sera of that kind confer a very short immunity.

1706. Is that the case also with surra?—There is no serum used as a preventive against surra.

1707. What is used against surra?—Usually the pistol. Animals are destroyed under the Act; no treatment or prevention is usually adopted.

1708. I have been sent a paper for translation which describes how a method of dealing with surra has been worked out in Dutch East Indies; it is called Bayer 205?—I have read that paper, but it cannot be carried out in India at the present time, because under the law all animals suffering from surra should be destroyed.

1709. Do you think these small associations which operate in districts on contagious disease work should be placed under the administrative control of the Provincial Veterinary Department?—Yes, I am strongly of that opinion.

1710. *Sir Thomas Middleton*: In connection with the training of your veterinary officers you indicated that the number of appointments in the higher service would be something like two or three a year; is that so?—I believe so.

1711. That is the probable demand? Now can you give any indication of the number in the subordinate service?—I can only judge by analogy; in Madras our annual recruitment of assistants is about a dozen, and there are 8 or 9 such Provinces in India.

1712. Where did the subordinates whom you recruited in Madras get their veterinary training?—At the Madras Veterinary College.

1713. For what period?—3 years.

1714. What period of training do you think would be required for the men in the higher service?—At least 4 years.

1715. And a higher entrance standard?—Yes, that is most important, of course.

1716. *Sir Ganga Ram*: Do you think salt is necessary for horses and cattle for their health?—I think it is.

1717. How much salt would you give?—The usual dose I believe is 1 oz. a day.

1718. Would it promote milk in cows if they were given salt?—I am afraid I would not like to answer that question without investigating it.

1719. *Sir Henry Lawrence*: Would you put the total bovine population of this country at about 150,000,000?—Probably. I think the large Provinces have an average of about 20,000,000, but I am hazy about the exact figures.

1720. I have a figure of about 150,000,000 for all-India?—It would be about that.

Mr. Calvert: It is in the Indian Year Book.

Professor Gangulee: That includes the Indian States.

1721. *Sir Henry Lawrence*: Can we have the figures?

Dr. Hyder: 47,000,000 bullocks, 40,000,000 cows and 40,000,000 young stock.

1722. *Sir Henry Lawrence*: Have you any idea of the total mortality from rinderpest in British India in a year?—No figures are published on these matters at the present time, but I can tell you definitely that in a bad year we have lost about 50,000 animals from rinderpest in Madras alone.

1723. 50,000 out of 20,000,000?—Yes, or so it was reported. I think those figures are approximately correct.

1724. The total number of doses for cattle that you issue from Muktesar would be somewhere about sufficient to immunise 300,000 or 400,000 cattle

a year?—Last year we issued 5,000,000 doses of rinderpest serum from Muktesar.

1725. Doses of 5 c.c.?—Yes.

1726. You want 16 of those doses to immunise, do you not?—By the simultaneous method, yes, but the vast majority of those doses are used in the serum-alone method. If one divided that figure by 3 or 4 it would give an idea of how many animals were immunised.

1727. How many animals, roughly, do you calculate were immunised?—A little over 1,000,000.

1728. Roughly, the cost would be Rs. 2 to Rs. 3 per animal, would not it?—It would be less than that by the serum-alone method. It would work out at about 12 annas.

1729. As little as that? I see from some figures that have been supplied to us that your Institute at Muktesar had receipts of 13 lakhs and an expenditure of 7 to 8 lakhs, so you have actually made a profit of 5 lakhs on the administration of your Institute?—Yes.

1730. That is fairly correct, is it?—Yes.

1731. That is money which goes into the coffers of the Government of India?—Yes.

1732. *The Raja of Parlahimedi*: Is there any special training necessary for men who give the inoculation for the permanent cure of animals?—In the case of rinderpest?

1733. Yes?—No training is insisted on, but it is usual, before a man undertakes these inoculations, to arrange for him to be trained.

1734. So he should undergo training?—In my opinion he should.

1735. Can this inoculation be given to animals at all stages, or are there any restrictions?—It is not usually performed on a cow if she is more than six months pregnant.

1736. Because the development of the calf is retarded?—It may produce abortion if she has a very severe reaction.

1737. Are the different breeds of Indian cattle receiving sufficient attention from the Veterinary Department for maintaining their existence; there are working animals and milking varieties?—You mean, as regards looking after them from the point of view of disease?

1738. Maintaining those different breeds of cattle in India?—Except in the Punjab, the Veterinary Department is not responsible for looking after cattle-breeding of any kind.

1739. *Sir James MacKenna*: The functions to be performed at Muktesar divide themselves into two distinct parts: (i) research; (ii) manufacture of serum?—I would put it the other way round: (i) production; (ii) research.

1740. That is the actual position, but of course research must precede manufacture?—Yes.

1741. The research stage being completed, the manufacturing process does not require so much supervision from highly-qualified officers; does it?—I think I must disagree with that. Supervision by highly-qualified officers is most essential in the manufacture of our products; the actual carrying out of the work, of course, can be done by others.

1742. The actual manufacture can be done by a routine process?—It needs constant supervision; I would like to emphasise that.

1743. At the same time, the whole of the research staff need not be occupied in the supervision of manufacture?—It depends on the size of the research staff. At the present time all our staff, with one or two exceptions, are employed on production and manufacture.

1744. What is your sanctioned staff?—A Director and 9 scientific officers.

1745. What is the staff engaged?—There is a Director, 2 other Imperial officers, and 3 Provincial officers,

1746. Instead of 10. Were the 10 sanctioned all Imperial officers?—No, the 10 are Imperial and Provincial together.

1747. So you are 4 short?—Yes.

1748. In 1913 there was a Physiological Chemist. Has that post disappeared now?—It was abolished.

1749. How many Bacteriologists have you?—I have not anybody who is known as a Bacteriologist, but I have a Pathologist who does a certain amount of Bacteriology.

1750. The fact of the matter is that this Institute is very badly equipped at present?—Exceedingly.

1751. Is not it a fact that during the last ten years the Institute has suffered very much from constant changes and resignations of the staff?—I tried to bring that out in my memorandum; it is undoubted.

1752. What are the reasons for these resignations? You have had a Physiological Chemist who has resigned, and a Pathologist, and a Director?—I think in nearly every case it was a question of personal reasons and, very unfortunately, practically all these men were lost to India. They resigned from Muktesar and went away. For that reason it would be very much better if it could be arranged that a man, who was not getting on well at Muktesar, could be transferred to a Province. I am afraid that is a difficulty now.

1753. Do you think the isolated position of Muktesar and the extremely uncomfortable conditions under which the officers live and work has had something to do with it?—I think the isolation has something to do with it. There is no doubt that after several years at Muktesar and never leaving the hilltop it is a common thing for an officer to become cranky and to fall out with his brother officers.

1754. What about your sub-station at Izatnagar? Could not that be developed to take over a great deal of the research work now being done at Muktesar?—I think it might, and at present there is a very big project before Government for developing it.

1755. Making Muktesar the sub-station?—I do not think that has been contemplated up to the present by past Directors, but it might happen.

1756. It would make a great difference to the amenities of the service?—It would.

1757. Then you refer to interchange of officers between Muktesar and the Provinces. Is it still the custom that Muktesar officers are regarded as outside the cadre of the Civil Veterinary Department?—I think at present our Imperial officers are carried on the cadre of the Indian Veterinary Service, but in the case of at least two of them they are not subject to transfer.

1758. I thought they were outside the cadre?—It has been changed of recent years.

1759. Do you consider there should be a Veterinary Adviser to the Government of India just as there is an Agricultural Adviser? You seem to imply that that officer should be the Director of the Muktesar Institute?—It should be a combined post in my opinion.

1760. How do you think the Provinces would take that?—I am quite certain it would be received with complete acclamation in the Provinces.

1761. Then on the question of veterinary education, Sir Thomas Middleton asked about the central college. That would be a course for the training of officers for the Indian Civil Veterinary Service?—Yes.

1762. But is it not a fact that a condition of admission to the Indian Civil Veterinary Service is membership of the Royal College of Veterinary Surgeons of England?—Yes, but I think the Indian Veterinary Service has now been completely abolished and the intention is that in the future what is known as a Superior Provincial Veterinary Service should be established,

1763. It means that whatever local qualification they may have, they will be of inferior standing to a Member of the Royal College of Veterinary Surgeons?—Until our colleges in this country are sufficiently advanced.

1764. Until you get the Royal College of Veterinary Surgeons to recognise it?—Yes. Of course it will be a matter of opinion as to whether they are inferior or not, even if the Royal College will not recognise them.

1765. I notice that the sale of your serum has gone up in a remarkable way during the last 10 years. How do you account for that enormous increase, especially with regard to rinderpest, where it has gone up 5 times?—I think in the first place it must be due to a very large increase in the number of outbreaks of rinderpest in the country. That is certainly true of the last year or two. Another big factor is the increase in subordinate staffs which has taken place in the Provinces so that there is now a very much larger agency for carrying out inoculations.

1766. You have had a considerable sale for your products outside India, to Mesopotamia, Ceylon and so on?—It still goes on, but I do not think it can be called considerable.

1767. It is not considerable now?—No.

1768. Of course during the War it was very great?—Yes.

1769. Apart from the central college we talked about, practically every Province now has its veterinary college for training its officers, has it not?—No.

1770. Madras has?—Yes, and Bengal, Bombay, the Punjab and Burma have.

1771. The Central Provinces?—No.

1772. Bihar and Orissa?—They talk of having one.

1773. The provincial veterinary college trains up to the highest grade of what one might call the Provincial Deputy Superintendent?—If as high as that.

1774. Do you think it desirable that the Royal Commission should visit Muktesar?—I think it most desirable.

1775. The whole Commission or a section?—A section of the Commission should; I am afraid to do anything more than that would be very difficult for us because of the transport.

1776. *Professor Gangulee*: In a country like India, which is an agricultural country, do you think the Government have paid adequate attention to veterinary research and education, speaking generally?—No, I think, speaking generally, they certainly have not.

1777. You have said in your memorandum that by far the greatest demand for advice and help comes from the Military Department. Do you obtain any contributions from the Military Department?—We do not.

1778. I see you refer to the recommendation that classes teaching up to the highest veterinary standard should be established in India and passed students of these classes should constitute the normal method of recruitment for the Imperial branch of the Department. Have any steps been taken to give effect to this recommendation?—No steps have been taken. A certain number of Indian gentlemen have been sent to England and have obtained the diploma of the Royal College of Veterinary Surgeons.

1779. In which Provinces in India are there facilities for veterinary education? There is in the Punjab?—Yes, and in Madras, Bombay and Bengal.

1780. None in the Central Provinces?—No.

1781. You recommend a central veterinary college. Do you think there is a real demand for such a central veterinary college?—I do not think I recommended a central veterinary college. I think, I pointed out the difficulties.

1783. Would you discontinue the provincial colleges and have one central college?—No, I would certainly not do that; I think it would be an enormous problem to try and educate all the veterinary assistants required in one college. Besides, of course, there is the question of language and taking a man so far from his home to be considered.

1783. In view of the fact that there is an inadequate demand for veterinary education, instead of diffusing your colleges all over the Provinces, would you centralise your efforts and make one central college?—And abolish those in the Provinces? No, I would not recommend that.

1784. Are you satisfied with the standard of instruction in these provincial colleges?—I am not.

1785. Have you any suggestions to make as to improving the standard of education of the provincial colleges?—Well, the first thing to do is, of course, to increase the number of years of study. At the present time, except at Lahore, students spend only 3 years at the colleges. The course contains no pathology and bacteriology, for instance, and until those two very important subjects are included, it is quite impossible to turn out an efficient veterinary graduate.

1786. I agree. Have you facilities at Muktesar at present for carrying on researches on all-India problems?—No, I think the list of research problems is so enormous that it could not be undertaken at one research institute without a very enormous increase in staff.

1787. Is there scope for research in every part of India?—I think there is scope for research in each Province. There should be a Pathological Department of the college where a college exists, and it should also carry out a certain amount of research.

1788. Referring to your executive work you say: "The only remark I wish to make is that there is no uniformity." How would you secure the desired uniformity?—It seems to me at the present time the only way to secure uniformity is by appointing some senior veterinary officer with the Government of India, who would by his own personal influence in the course of his tours suggest certain improvements in each Province until he had managed to get them all more or less the same.

1789. Referring to what you say as to Veterinary Police measures, do you think legislative efforts in this direction are likely to be successful in India?—I think it is going to be very difficult, but I would certainly emphasise the necessity for instituting such measures and making a start, which has not been made up to the present.

1790. What are the real difficulties, do you think, in the way of introducing cattle disease legislation?—Well, I suppose the greatest difficulty is bound to be, in the first place, the backwardness of the cattle-owner, the ryot.

1791. Is it possible to have uniformity in regulations throughout India?—It might be possible if there were some central veterinary authority, but it certainly does not appear to be possible under our present organisation.

1792. You rightly point out here that contagious disease knows no boundaries. How would you control inter-provincial movement of animals?—As far as I can see, it can only be done by the central authority, or Central Government, placing a particular Province in quarantine. I believe that is done in America: If any particular State is affected by scheduled disease, that State is placed in quarantine.

1793. Do you think anything could be achieved by co-operation with the railway?—I think so, yes, because in these cases it is usual I think for a certain amount of movement of animals to be allowed under supervision.

1794. How would you control the spread of disease at these big cattle markets and fairs?—The obvious thing to do, of course, is to close the fairs and cattle markets for the time being.

1795. You make a case for a central veterinary bureau; what would be the exact functions of this bureau, purely advisory or executive or both?—I would prefer to say both; but I think it remains to be seen whether that is going to be possible. It would certainly be advisory.

1796. Turning to the question of administration, at the present time the Agricultural Adviser is really in charge of Muktesar?—It is under his administrative control, yes.

1797. What is the advantage of this arrangement?—I am afraid I do not see very much advantage in it. I think I should explain that it was an arrangement arrived at in 1912 when the post of Inspector General of the Civil Veterinary Department was abolished; ever since those days the Director of Muktesar has been a very junior officer and it was necessary for him to be placed under somebody's control. But, considering our work there, I think it would have been more appropriate if he had been placed under the control of the Director General, Indian Medical Service, as he actually was many years ago.

1798. In your memorandum you say that the administrative control of the Muktesar Institute is in the hands of the Agricultural Adviser. The Imperial dairy herds in Bangalore, I suppose, are also under the administrative control of the Agricultural Adviser; and yet you say the connection between this institute and Imperial dairy herds is not a very close one. How do you account for that?—I am referring to the fact that although we are an Imperial Institute and these are Imperial herds, there is no member of our staff attached to these herds, as I think should be. The result is that it is only very occasionally we are asked to visit the herds and give our advice. I think it would be far preferable if we were given more responsibility in the matter.

1799. I see you say that veterinary being a transferred subject it is difficult to make provision for the proper co-ordination of the work in different provinces. Are you referring to the scientific or the administrative side?—I was referring to all phases of our work.

1800. Do you think that scientific work knows any provincial boundary?—It does not.

1801. In what way do you think that the fact that the veterinary service is a transferred subject has affected that co-ordination?—Because, as I understand the position now, even if we had a Veterinary Officer with the Government of India, he could only act in an advisory capacity; he could only visit a Province if he were invited to do so. That is, as I understand, the position and it is very difficult to get over that.

1802. In answer to a question by the Chairman you emphasised the superstition of the cultivator. At the same time I see there has been a phenomenal increase in the demand for your sera?—I can only say that this has been done in spite of the superstition of a large number of the populace, and if that could be removed we should do even more inoculations, I take it.

1803. That indicates that we can go ahead in spite of this superstition?—Yes, there has been a very great advance.

1804. You made a profit last year of about 4½ lakhs of rupees on the sale of sera, did you not?—Yes.

1805. And it is now a recognised biological product. Would it not be possible to interest some commercial firm to take it up under some Government control?—I suppose it might be possible; but I think it would need nearly as large a controlling authority as it requires staff for the production.

1806. In the case of human diseases we trust ourselves in the hands of private bio-chemists; do you not think it is possible in the case of bovine diseases?—Yes, it is certainly possible, but very careful standardisation would be necessary.

1807. The commercial firm might standardise it for their own benefit. Is there any scope in that direction?—Knowing the difficulties of preparing

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anti-rinderpest serum, I cannot imagine any commercial firm taking it up, but it certainly is a possibility.

1808. *Mr. Calvert*: On the question of the enormous increase in the number of doses of serum issued, has that large increase interfered with the research section of your work?—I would not say it has interfered with it.

1809. Has it distracted you from the research work?—As I understand ever since the beginning most of the staff at Muktesar has been employed on manufacture, and you will notice that although there is quite a long list of publications relating to work done at Muktesar, a great deal of it is in connection with research into production, and it is not what I would call pure research.

1810. Assuming now this rate of increase continues, would you be able to meet the increasing demand?—Yes, I think with the development of Izatnagar we should be able to meet any demand.

1811. I once committed myself to the opinion that preventible mortality amongst cattle was a prominent cause of borrowing by cultivators. Does your village experience corroborate that?—I am afraid I have not any information on that point.

1812. Is the Punjab Veterinary College the only one in India which is now affiliated to a University?—It is the only veterinary college.

1813. I suppose the lack of control of disease is a bar to the production of high class animals?—It is certainly a fact that if disease visits a village it always seems to carry off the high class animals first.

1814. Is not it true that in England very little progress was made in cattle-breeding until the land enclosures took place?—I am afraid I could not answer that question.

1815. I understand that in England until cattle were enclosed in the fields and so prevented from mixing with the common herd, no progress was made in cattle-breeding because each man's cattle were exposed to any disease of the village common herd?—Yes, the only point is that it must go back a very great number of years.

1816. 1745?—It is of course perfectly understandable.

1817. As long as the cattle mixed with the common herd, you could not risk putting out an animal worth about half a lakh of rupees?—Certainly not.

1818. So that as long as you had your animals mixing with the common herd, you could not really make much progress in the way of high class breeding?—It certainly stands in the way.

1819. *Dr. Hyder*: I do not know whether you should answer this question or my colleague Mr. Calvert—does this system of enclosures prevail, for example, on the Continent of Europe, in Germany and especially in Russia?

Mr. Calvert: I am only speaking of it as a means of preventing the spread of contagious diseases.

Dr. Hyder: Rinderpest prevails here to a greater extent than in Russia, but there they have not got a system of enclosures.

1820. *Mr. Calvert*: You have no difficulty, then, in meeting the present demand for serum?—No.

1821. Is it a fair question to ask you, whether you think the horse will ever be of economic value in agriculture in India, or does the climate prevent the horse being a good draft animal?—I should think so; I cannot foresee the horse being of any use, at any rate, in the south of India, where our indigenous horse is very rarely over 13 hands. I have not very much information regarding the north of India.

1822. You do not wish to speak of cattle-breeding?—I have got no detailed information.

1823. *Mr. Kamat:* You have said in your memorandum that the present arrangements for running Muktesar have definitely failed, and that you would advocate the immediate creation of the post of Veterinary Adviser; you also say it would be advisable to combine the post of Director and Veterinary Adviser to the Government. What is your scheme, that it should be a separate post or a combined post?—In addition to administering the Muktesar Institute, I would make the Director also Veterinary Adviser with the Government of India, as I believe is the case both at Pusa and at Dehra Dun at the present time.

1824. Just as the Agricultural Adviser is also the Director of the Pusa Research Institute, you would make the Director of your Veterinary Institute the Veterinary Adviser?—Yes.

1825. But in this memorandum we are told that the work of the Imperial Institute of Veterinary Research has so increased that the Director cannot attend both to his research work and his routine work. Is that so?—Yes.

1826. Is it also true that the Director has to supervise a vast estate of something like 2,000 acres at Muktesar?—Nearly 4,000 acres.

1827. And yet you think the Director can combine the additional duty of Veterinary Adviser to the Government of India?—I think it certainly could be arranged by adding, if necessary, a personal assistant to his staff. A certain amount of his internal work could then be delegated to this assistant.

1828. That is to say, under your arrangements the Director would require some further assistance?—I would not say so at present; I think these two posts could be combined quite well at the present moment.

1829. You have also told us just now that it would be desirable to have research work done in the Provinces. I want you now to visualise, if you are in favour of overhauling the whole thing, how your scheme as a connected whole would work both at Muktesar and in the Provinces. I will ask about the Provinces first. You would attach to the veterinary college a research laboratory and research work?—Yes.

1830. Which would be in charge of a veterinary officer of some high grade?—Yes.

1831. Would such local research institute in the Provinces relieve the research work of the Muktesar Institute?—It would not relieve research work there, but it would be the means of turning out more research work for India as a whole. It would merely add to the amount done.

1832. I mean certain local problems of research could be tackled in the Provinces?—Yes.

1833. Thereby relieving you of certain problems which you are now solving at the instance of local Governments?—Which we would like to solve, but we have not the staff to do it.

1834. In the Provinces you have advocated that the Veterinary Service should be in charge of a high administrative officer instead of the present arrangements?—Yes.

1835. That is to say, instead of the superintendent, you want an officer of a higher grade?—Yes.

1836. You have also said that the training at the veterinary colleges in the Provinces should be improved?—Yes.

1837. And the subordinate services should be strengthened; is that right?—Well, they are being added to, of course, every year; but there is still a good deal more to do.

1838. Have you considered the cost to the Provinces of such a scheme?—I have not worked out any figures, no.

1839. Would it be possible for the Provinces besides doing research work to start manufacturing the sera just as you are doing at Muktesar?—It is quite possible that a certain amount of serum production work might be undertaken in the Provinces, but I am very doubtful whether any of the

present provincial veterinary officers would be inclined to advocate that policy, when it can be made at Muktesar where all our arrangements are in working order, and the serum distributed by rail at a small cost.

1840. *Mr. Calvert*: Is a large city where most of these colleges are situated, a suitable place to manufacture these sera?—It could be done near a large city.

1841. There is no danger at all?—No, there is no danger, under proper precautions.

1842. *Mr. Kamat*:—Given a research officer for the Provinces under whose supervision manufacture also could be carried out, would it be possible for the Provinces to manufacture sera in a self-supporting manner, that is to say, the proceeds to balance the expenditure? I am trying to find out whether a policy of decentralisation would be a practicable policy?—I think it is a very difficult question to answer without going into some figures.

1843. If you are making it a self-supporting commercial proposition to manufacture your sera at Muktesar at present prices, would it be possible, I ask, for even the Provinces to manufacture their own sera and make it a self-supporting proposition if you decentralise?—Of course it would mean having a very greatly increased expert staff: I mean a staff who have been specially trained in this class of work; and it seems to me it is doubtful whether it would pay each Province to maintain such a staff for the amount of sera it is going to require.

1844. We have been told in this memorandum that the present system of bringing in Directors for the Muktesar Institute with a definite number of years of service could be improved by having a cadre and taking men from the provincial cadre by promotion to Muktesar. If that idea is carried out, would not it be possible to have in the Provinces men of high standing and with prospects of being promoted to the Muktesar Institute? Do you follow what I mean?—Yes.

1845. I want to get over your point by developing, or rather carrying out, the system set forth?—As I said just now, it would mean a very large increase of staff in each of the Provinces if they are going to undertake the manufacture of their own sera, and it is quite easy to see that these provincial staffs might be increased to such an extent that there would not be any outlet for them at Muktesar.

1846. Would not this scheme have the double advantage of removing some of the discontent to which you referred at the beginning of your remarks and also, by this process of decentralisation, popularise sera work and bring it to the notice of villages in the Provinces? At present you are too isolated, and your work is not as well known as it ought to be, whereas if it were carried out in the Provinces it would be well known in the neighbourhood?—I cannot see that it would lead to any improvement if the production of these sera and vaccines were undertaken, for instance, in places like Bombay and Calcutta instead of at Muktesar, because these big towns are a long way from the villages where the sera are actually used.

1847. But the officers immediately in charge would see to that. It would be their business to popularise it, whereas you are too far away to do so?—I think it could be popularised quite as well by the ordinary executive officers in the Provinces.

1848. Under your proposal, to give some sort of relief to the Director by additional staff, additional expenditure at Muktesar would be involved, would it not?—Yes.

1849. Under this scheme of decentralisation, is it possible if we have research work done in the Provinces that you may not require those additional officers at Muktesar?—There is a very large amount of research work in veterinary matters waiting to be done. I should like to see an increase in research work and research staff both at Muktesar and in the Provinces.

1850. And in the Provinces?—Yes.

(The witness withdrew.)

The Commission then adjourned till 10 a.m. on Saturday, the 16th October, 1926.

APPENDIX.

Note on Veterinary Research in India. Its Co-ordination and Financing.

In continuation of the previous evidence which I have offered to the Commission I beg permission to submit this further note, in which I make some proposals regarding the future co-ordination and financing of veterinary research in this country. It has been my previous endeavour to show (1) how much veterinary research work there is to do and how little has been done up to the present, (2) how completely unorganised are the veterinary staffs, and (3) how it is a mistake to think that veterinary work ends with agricultural animals.

Assuming that these points are admitted, my first proposal is the establishment of a Veterinary Research Council for India, to consist of the Director and at least one Research Officer from the Central Institute at Muktesar, a representative from the Civil Veterinary Department of each of the major Provinces, one or two representatives from the Indian States, together with an officer from the Army Veterinary Department in India, and the Public Health Commissioner with the Government of India, in order to ensure close co-operation with their respective departments in matters of research. Contact with the Agricultural Department would be obtained by placing the Director of the Muktesar Institute, or as I should prefer him to be called, the Veterinary Adviser to the Government of India, on the Agricultural Advisory Council contemplated by the Agricultural Adviser in his evidence before the Royal Commission.

This Veterinary Research Council would meet at least once a year, discuss the research work carried out during the previous year, and consider the programme for the coming one. In this way an opportunity would be provided annually for the ventilation of all urgent problems, and at the same time overlapping of work would be prevented. This Council would, of course, also supervise through a small Committee the publication of the results of veterinary research workers in this country. The main lines of work decided upon would naturally fall on the Central Institute and its branch laboratories, but it would no doubt be possible, as well as desirable, to allocate certain subsidiary lines of work to the provincial laboratories. This would in no way interfere with the freedom of the provincial departments in carrying out researches from funds which they are able to obtain from their own Government, for it is intended that any additional work undertaken by them at the request of the Veterinary Research Council should be paid for from a fund, the details of which will be described later.

In the same way as it is anticipated that, as a result of the evidence placed before the Royal Commission, local Governments will see the necessity of providing funds for research into local veterinary problems, so is it expected that the Government of India will in future devote a definite part of their revenue each year to veterinary research to be carried out at Muktesar and any permanent branch laboratories which may have been established in connection with it; and while on this subject the advisability of transferring to Muktesar the direction of a special investigation like that of the Camel Specialist at Sohawa, now under the Punjab Government, may be referred to. It is obvious that there must be a much greater accumulation of research experience at a large Central Institute like Muktesar than in a provincial department, where executive and educational matters are necessarily the first consideration, and moreover the question of camel diseases is not confined to the Punjab, but it affects the whole of Northern India. Apart, however, from the funds likely to be provided annually by the different Governments for veterinary research something more permanent is required. Those funds are liable to considerable fluctua-

tion each year, either on account of changes in revenue, political party in power, or personnel of the Ministry, and it is most essential that there should be available a permanent fund, which could be drawn upon, either to start a new piece of urgent work, or continue one already in existence which is likely to be closed down owing to the lack of Government funds. I can quote two specific instances of recent occurrence where it is unlikely that an important piece of veterinary research work would have been undertaken if Government funds had had to be entirely relied upon. One of these is an investigation, which is still proceeding, into bovine tuberculosis at Muktesar and the other, some work on pyroplasmosis in the dog in Madras. In each of these cases the Indian Medical Research Fund came to the rescue and provided part of the funds, but it is obviously desirable that there should be a Veterinary Research Fund for such work.

As regards the establishment of an Indian Veterinary Research Fund my proposal is that the Government of India should be asked to form the nucleus of this Fund by placing in it each year an amount equal to that made as a profit by the sale of biological products from the Muktesar Institute. If the price of these products is regulated so that in a year when the demand is small this part of the Institute will just pay its way, it is obvious that when the demand is large, either from within or without India, a considerable increase in receipts over expenditure must result, as happened in the year 1925-26, and it seems most appropriate that when this happens this money should be set aside for further research into problems of animal disease. Others which might be expected to contribute regularly to this Fund would be the Army Department in India, for the investigation of problems affecting horses and other military animals, the proposed Agricultural Advisory Council for researches undertaken particularly at their request, and, of course, contributions from the Indian nobility and other private persons interested in the domestic animals should be encouraged to the utmost.

The allocation of money from this Fund would be made at the annual meeting of the proposed Veterinary Research Council, and in order that this shall be done to the satisfaction of the Government of India they might wish that a Secretary to Government in the department concerned should sit on the proposed Council.

Saturday, October 16th, 1926.

SIMLA.

PRESENT :

The MARQUESS OF LINLITHGOW, D.L. (*Chairman*).

Sir HENRY STAVELEY LAWRENCE,
K.C.S.I., I.C.S.

Sir THOMAS MIDDLETON, K.B.E.,
C.B.

Rai Bahadur Sir GANGA RAM, Kt.,
C.I.E., M.V.O.

Sir JAMES MACKENNA, Kt., C.I.E.,
I.C.S.

Mr. H. CALVERT, C.I.E., I.C.S.

Raja SRI KRISHNA CHANDRA GAJA-
PATI NARAYANA DEO of Parlaki-
medi.

Professor N. GANGULEE.

Dr. L. K. HYDER.

Mr. B. S. KAMAT.

Mr. J. A. MADAN, I.C.S.

Mr. F. W. H. SMITH.

} (*Joint Secretaries.*)

**Mr. J. S. PITKEATHLY, C.I.E., C.V.O., C.B.E., D.S.O., Chief
Controller, Indian Stores Department.**

**Memorandum on the Manufacture and Sale of Agricultural Implements in
India.**

There is a number of foundries and engineering workshops in India capable of turning out agricultural implements and machinery of suitable design and quality. In the case of the simpler implements such as ploughs, cane mills, chaff-cutters, etc., it has been proved that manufacturers in India can successfully compete with the prices quoted for imported implements.

There are in addition numerous importing firms who hold agencies of well-known English and American manufacturers of agricultural plant and machinery, and hold ready stocks of these goods.

In a few cases manufacturers in India have been successful in disposing of considerable quantities of ploughs and cane mills, but it can be safely stated that the fringe of development has hardly yet been touched. Manufacturers generally complain of difficulty in getting into touch with the actual buyer because of the vast area to be covered, and they state that it would not be a practical commercial proposition to set up the organisation necessary to canvas potential buyers, and to distribute the implements which they are in a position to manufacture. In many cases they explain that payment, for such implements of a modern type as are used, is not made by money, but there exists a system of hiring, payment being made in kind. No modern engineering works could contemplate doing business on these lines, and it is therefore necessary to employ some agency which would distribute the implements to the farmer, and, if necessary, afford facilities for payment on an instalment system, and collect payments as they fall due. The only organisation of such a character available is Government itself and this problem of distribution therefore is capable of solution only by Government.

The Indian Stores Department understands that implement depôts have already been established in some Provinces and that they have amply proved their value, but it is necessary that the number of such depôts should be increased.

It is believed that Provincial Governments provide credit facilities by a system of *taccavi* loans, but that the amounts allotted for this purpose are quite inadequate. If it is really intended to give impetus to the development, these credit facilities should be increased, and as it is understood that the loans are properly secured and that failures to repay are the exceptions, Provincial Governments should not be unwilling to provide further accommodation.

Moreover, manufacturers would be willing to bear a part of this burden of affording credit provided that payment of their bills was guaranteed by the Provincial Government concerned. In a number of cases manufacturers in India would be prepared to invoice their goods for payment in six or even twelve months' time, but a premium would naturally be added to provide for the loss of interest involved.

Implement depôts could be reimbursed for the expense in connection with sales and collection of payments by means of a discount given by suppliers.

Oral Evidence.

1851. *The Chairman*: Mr. Pitkeathly, does your department purchase implements for free distribution or for sale?—My department only purchases implements against specific demands. We comply with an order when we receive it.

1852. **are** there any obstacles to the adoption of improved varieties of implements for the removal of which you would care to make suggestions?—I would answer that question by saying that one of the main difficulties in the way of the ryot adopting improved implements is finance. The ryot is a poor man and he cannot meet the financial cost of the implements. Another difficulty is the difficulty of distribution. The users are spread over a very large area and firms in India have difficulty in getting into touch with the users. In order to overcome this, it would be necessary to establish in various parts of the country dépôts for the issue of implements either on sale or on hire. Another difficulty is the lack of skilled labour. The ryot is entirely ignorant of engineering matters and in the higher class of mechanical implements such as tractors, many of the failures in the past have been due to a lack of knowledge of engineering on the part of the user. Then another difficulty is the lack of facilities for repairs and facilities for obtaining spare parts when a part goes wrong.

1853. Have you any methods that you wish to suggest for the cheapening of implements?—The most important method for cheapening implements is standardisation. At present we have innumerable types of implements and the existence of a large number of types reacts on manufacturing in this way that firms have got to maintain a large number of jigs, tools and appliances for the manufacture of these different types. The only way in which you can cheapen implements is by placing a steady flow of orders for implements of more or less the same type.

1854. So that mass production is the ideal?—Yes.

1855. You think that mass production would substantially cheapen implements?—I am certain of it. We have in front of us the example of the motor car industry in America and in Europe. Only a few years ago a motor car was beyond the reach of any one but a fairly wealthy man, but to-day a comparatively poor man can afford a car.

1856. Do you wish to say anything upon the provision of pumps for wells?—Here again I think the only way to develop mechanical pumping is by standardisation. We have in India to-day many types of pumps and prime-movers. With no exception they are all too complicated. I personally feel that the right type of pump and prime-mover for wells has not yet been invented. The essentials are that it shall be cheap and reasonably efficient. To-day the cost of a pump and engine, capable of dealing with a well the yield of which may be 5,000 gallons an hour, is somewhere in the neighbourhood of Rs. 1,200.

1857. Does that include the prime-mover?—Yes. Very few Indian agriculturists can possibly afford an initial cost of Rs. 1,200. There again by standardising and by giving firms large orders you will be able to reduce the price very considerably. Manufacturers should aim at producing a pump and prime-mover at a cost somewhere in the neighbourhood of Rs. 300.

1858. There again it is a matter of mass production?—Entirely a matter of mass production.

1859. Do you wish to develop at all your suggestion that the Government should facilitate the purchase or hire of improved appliances?—My view is that the engineering branch of the agricultural services should be very considerably strengthened, and should go in for a great deal more propaganda and a great deal more education than at present. Not only so, but they ought to establish dépôts in various parts of the country, not necessarily for the sale, but for the issue on the hire-purchase system if necessary of implements, pumps and all kinds of mechanical appliances used in agriculture. Also a very necessary part of their duties should be the training of skilled mechanics and operators required for running these appliances.

1860. Do you agree that there is an important opening before firms in India able to produce implements and appliances?—I agree, provided something is done to help to bring these firms into touch with the users and also to give them a definite assurance of a take-off for their products.

1861. You do not think they are capable of developing that outturn by the ordinary commercial means?—I do not think so.

1862. But once the flow of orders was established, then I take it you contemplate Government standing aside?—I do.

1863. Is there any other subject upon which you would care to address the Commission?—I do not think there is any subject on which I can talk from intimate experience.

1864. I just want to make one point clear. Your department does not produce or manufacture for sale or distribution to cultivators any agricultural implements, does it?—No. I have here a pamphlet* in which we have described the functions of my department. I can send as many copies to the Commission as they require.

Yes, I think we should like a few copies of that if we might have it.

1865. *Mr. Kamat:* Do you expect mass production in this country on the American scale on the part of Indian manufacturers in the near future?—Yes, provided Government gives the manufacturers definite encouragement. You would start by instructing the ryot in the value of improved methods and create the demand, then you will have mass production.

1866. You mentioned the example of American mass production in motor cars. You had Henry Ford's business in view. Can an effort on that big scale ever be thought of in India on the part of manufacturers even with Government assistance?—I do not think it would be necessary to undertake a factory on the Henry Ford scale, but the principle remains, that producing a large number of articles of the same size and design is the only way to cheapen production.

1867. Taking the Indian ploughs required for different soils, heavy soil, light soil, medium soil, is it possible to standardise any of these various types of ploughs?—I consider it possible to standardise a certain number of types, each type being suitable for a different type of soil. At present we have perhaps 30 or 40 different types differing in very small essentials. All these small essentials should be worked out and brought down to a common standard.

1868. How many types do you expect will be necessary as the minimum for the different soils of this country?—I should think eight or nine.

1869. So that standardisation will have to be reduced to at least eight types?—Yes.

1870. And your suggestion is that Government should subsidise establishments for all these different types?—An establishment to develop the type suitable for the soil in each particular area.

1871. When placing your orders with different firms for machinery, what procedure do you follow in order to encourage and support manufacturers?—My department is governed by rules issued by the Government of India called the Stores Purchase Rules. These rules definitely lay down that in the case of articles manufactured in India from Indian material, we shall give a definite preference to them over imported articles. Rule 2 lays down that articles manufactured in India from imported material shall also be given a preference over articles not manufactured in India. These are the principles we follow in placing orders.

1872. Is it a definite percentage of your total order that you give to the Indian manufacturers, or what is the substance of the rule which you quoted?—The procedure we adopt is that if prices are equal and one article is made

* Indian Stores Department. Its Organisation and Functions, Government Press, 1926.

in India and the other is not made in India, the order will be placed with the Indian manufacturer.

1873. The whole of the order?—The whole.

1874. It is not distributed?—It is not distributed provided it is within the capacity of the Indian manufacturer to undertake. In the case of a difference in price against the Indian manufacturer, we have a figure in our mind and we place the order with the Indian manufacturer provided the price is not above a certain figure. In this matter we have to keep in mind the interests of the consuming department.

1875. If the difference in price is very slight, have you any discretion under the present rules in spite of the difference in price to give preference to certain firms?—I have discretion under Rule 1; I am allowed to place the order with the Indian manufacturer provided the price is reasonable.

1876. Looking to the quality?—Yes.

1877. You follow that principle?—We follow that.

1878. *Mr. Calvert*: To what extent are you able to assist village industries?—I have examined our records of purchase of the last few years and up to date we have placed with co-operative credit societies and industrial societies orders to the value of Rs. 55,000 only. These orders are for *durries*, *hungees* and dusters. Our difficulty in dealing with these societies is that in many cases the prices are not competitive, the prices do not compare with the prices quoted by industrial concerns using machinery. Again we have great difficulty in getting the required standard of manufacture. The standards are sometimes low and there is also lack of uniformity. We recently had a case where we bought a large number of dusters for the army. These were bought against specification. Orders were placed in the Punjab where dusters were manufactured. It was found that the materials did not comply with the specification and were rejected. There are other cases where we placed orders for *durries* and they have been more successful in manufacturing *durries*. The attitude which my department takes up towards these societies is sympathetic. We are anxious to place business with them. We receive tenders from them. Wherever possible we consider the question of giving them an order if it is within their capacity and the specification is such that we feel they can reasonably work to.

1879. But do you not think that the co-operative societies might be more successful in complying with your requirements if your requirements were more carefully explained?—In one or two cases we have discussed the matter with representatives from your societies before placing the order. We went into the question in detail and explained more or less what measures were required in order to produce articles to suit our specification but still there have been difficulties. My feeling about it is that your societies have got to improve their organisation and they have got to have greater experts dealing with particular things which they wish to manufacture.

1880. I take it then that you are prepared to do all you can reasonably to encourage village industries?—In every way possible; we are anxious to encourage them.

1881. *Professor Gangulee*: What would in your opinion be the effect of the introduction of labour-saving machinery for farm operations?—I am afraid I have not sufficient knowledge of agricultural conditions to give you an answer.

Would it not affect agricultural labourers?

(*The Chairman here remarked that the witness had made it plain that he did not know.*)

1882. You referred to mass production and standardisation. Would you suggest establishment of large industrial works for the purpose?—I would not recommend any State aid in connection with the establishment of agricultural implement works, beyond bringing them into touch with users and also developing the use of implements and encouraging farmers to use the implements.

Private enterprise would do all that is necessary beyond that in the way of establishing works and manufacturing implements.

1883. *Sir James MacKenna*: Do you consider agricultural engineering of vital importance to the development of agriculture?—I consider it a matter of great importance.

1884. You consider that the agricultural engineering sections should be strengthened and developed in all Provincial departments?—Yes.

1885. And do you consider that agricultural engineers should be members of the Indian Agricultural Service?—I do.

1886. *The Raja of Parlakimedi*: How would you solve the difficulty of distribution among the Provinces?—That is a matter that I would leave to the Provincial Agricultural Department. They, in consultation with the ryots and the manufacturers, would get out a type and design of implement which would suit their particular area. Having done that, the type ought to be standardised for that area.

1887. Are the Government considering how to improve ploughs and pumps used in different Provinces now?—I understand the Agricultural Department have done a very great deal to improve the design of pumps and mechanical appliances generally, but I do not think they have gone far enough.

1888. *Sir Henry Lawrence*: Do you ask this Commission to recommend further Government expenditure on your department, and if so, in what particular direction?—Having standardised various implements and various mechanical appliances, I consider the next step is to centralise and co-ordinate purchases in order that one co-ordinating authority may be able to examine the manufacturing capacity of each of the works manufacturing these appliances. Then that co-ordinating department could place orders up to the full economic capacity of the works concerned. That brings me to another point. Many of the appliances which are manufactured in India to-day have failed because of the quality of the material used and the standard of workmanship not being as high as is required. These difficulties can be got over if all appliances and implements were subjected to a very rigid inspection before they were despatched from the works.

1889. To what extent would the department require to be strengthened for this purpose and what would be the further expenditure involved?—Our existing organisation could deal with it, I think.

1890. *Sir Ganga Ram*: At what rates do the railways carry implements in this country?—I am afraid I cannot quote figures from memory.

1891. Do they give any concessions?—As far as I am aware, no.

1892. What is the import duty on implements?—There is no import duty. Implements are allowed in free, provided they are used for agricultural purposes.

1893. If we copy implements in this country, what difficulties would there be?—There is no difficulty in copying implements; it is done very freely now.

1894. It can be done?—Yes, if the implement is not patented. If it is patented then the manufacturer in this country would have to come to some arrangement with the owner of the patent to manufacture under a license.

1895. Scrap iron of the railways is sold very cheaply nowadays. I ask you as an engineer whether we cannot utilise that for the purpose of making implements in this country?—That is to me a question of economics. If we are going to make these implements, we have got to make them very cheaply. The using of scrap iron will entail in many cases a very great deal of fabrication. Your scrap iron will come in all shapes and sizes. You have got to reduce that to the size required to put into the plough or harrow or other machine you are fabricating. In many cases the cost of working up the scrap iron will to my mind make the whole project uneconomical.

1896. I recently bought one harrow from Spedding & Co. for Rs. 35 but I was able to make one for Rs. 10 out of scrap iron?—It is quite possible that

you can make one or two or a dozen or a hundred. The question is manufacturing in large numbers at economic prices.

1897. If I could give an order for 100 at a time, I could make it for Rs. 8 instead of Rs. 10?—Another point in connection with that is that if we are going to develop implements in this country and encourage their use, the great point is that it is absolutely necessary that all parts should be interchangeable. If you are going to utilise scrap iron, I am perfectly sure it would be quite impossible to guarantee interchangeability.

1898. Are you aware of the fact that sugar mills are nowadays hired to the zamindars for the season and the contractor who hires them gets his own man to go about and repair them. It is only on that system, in my opinion, that it would be possible to carry on with these implements. I wonder whether Government should give some help in the way of *taccavi* in that respect?—I am aware that in the Punjab and Bengal certain firms are carrying on a large business in connection with sugar-cane mills, and with the type of organisation that I had in mind, when I referred to the establishment of depôts for the issue of these implements either on hire-purchase or rent per annum.

1899. When you said in reply to the Chairman that a pump could be made for Rs. 300, what kind of pump had you in mind, and would that include the prime-mover?—I think probably my answer was not quite clear. I said that the ideal type of pump has not yet been produced. There are three considerations, to my mind, for the ideal pump: (a) it should be cheap, (b) it should be reasonably efficient and (c) it should be very simple.

1900. What kind of prime-mover would you suggest?—An oil engine.

1901. What is the size of pump you have in mind?—I have in mind a pump capable of pumping 3,000 gallons per hour at the outside.

1902. 3,000 gallons to a lift of what?—To a lift of 12 to 15 ft. pumping into an open channel.

1903. Are you aware of the fact that oil engines are now made in Lahore?—I have heard that they are making oil engines in Lahore; in fact, several firms in India are making oil engines to-day.

1904. *Dr. Hyder*: Do you think the technical conditions for mass production exist in the case of manufacture of agricultural implements?—Yes, I think so.

1905. What is your view of the recent changes in the tariff and the granting of subsidies to the iron and steel industry in their bearing on the welfare of agriculturists?—This is a question I should not like to answer straight off. I should like to think over it.

(The witness withdrew.)

**Mr. A. RODGER, O.B.E., Officiating Inspector General of Forests,
Dehra Dun.**

Memorandum on Forestry and Agriculture in India.

The attitude of primitive races to Forests.—Primitive races, who live mostly by agriculture, have as a general rule, in every part of the world, regarded forests as being part of the bounteous provision of Nature. They have seldom considered that they were in any way concerned in preserving the beneficent effects of the soil, rain and the sun, which they have been accustomed to regard as being inexhaustible sources of all that is required to produce crops. Forests have been, as a rule, placed by them in much the same category, and have been drawn upon to an ever-increasing extent as soil fertilisers and as suppliers of timber and fuel. It has seldom occurred that primitive agriculturists have realised that a time might come when the advantages conferred by forests in their neighbourhood would disappear, when the forests themselves vanished, and they have heedlessly continued the wanton destruction of the forests which have been literally the principal source of their livelihood.

Recent and present destruction of forests in India.—As a result of the increase of population in India due to the peaceful conditions which have obtained under British rule, land for grazing and cultivation has become ever scarcer and the forests have continued to suffer. One of the most destructive methods of cultivation is that known as *jhuming* or *taungya* cultivation. This system is still carried on over many hundreds of thousands of acres in the hilly parts of India and especially in Burma and Assam. The following extract from a lecture delivered by J. C. Mills, I.C.S., on the Assam-Burma frontier will give a good idea of what it means:—

“The Sema (Naga) method of cultivating rice, job’s tears, and millet is that known as “*jhuming*”. The jungle is felled and allowed to dry. It is then burnt and the ashes dug into the soil, and the crop sown. The same area is used two years in succession, and is then abandoned until enough jungle has grown up for it to be used again—usually from five to ten years. Of course, the thicker the population the shorter the period of rotation before the same land has to be used again, and the less chance the jungle has of growing up. The less the jungle grows up the more the soil is denuded, and the less soil there is the less jungle there will be in future; and so on in a vicious circle. A secondary effect is that the less roots there are in the soil the less is rain held up, and the more quickly do torrents come down in flood.

The denudation is terrible. Once from a hill top after some heavy rain I could count no fewer than thirty-six new landslips on the opposite side of the valley over which I was looking. Scores of tribes in Assam and Burma practise “*jhuming*”, and what is going on in the Sema country is only an example of what is happening over a huge area. Vast quantities of soil are carried down the rivers, which deposit the silt as they slacken speed in the plains. One result has been the gradual growth of huge sandbanks at such places as the junction of the Brahmaputra and Ganges near Goalundo. These in turn hold back the water and cause floods, which do an immense amount of damage to crops in the plains. I do not mean to imply that sandbanks would not be caused in any case. But the amount of silt brought down by rivers flowing through virgin jungle is very different from that carried by streams fed from steep hillsides covered with freshly dug soil on which rain has been pouring at the rate of half an inch an hour or more.

"Altogether, the problem is a difficult one. To forbid "*jhuming*" is impossible: it would condemn thousands of people to starvation. Moreover, "*jhuming*" by tribes who are not compelled by pressure of population to use the same land too often, and who leave a reasonable number of trees standing on the land, probably does no harm at all. It is in the crowded areas such as the Sema country that the harm is done. There we are trying two remedies with some success. We have been sowing quick-growing trees, such as Nepal alder and acacia, which will hold the soil, and we have been teaching Semas to terrace like the Angamis.

This "*jhum*" cultivation is one of the most primitive and probably one of the earliest methods of those employed by man, and must, it seems, have preceded irrigation. One wonders whether it was not one of the causes of desiccation of large areas of the globe. Possibly hill-sides which are now bare rock were once covered with forest. As this was "*jhumped*" denudation would set in, and the destruction of forests would cause a diminution of rainfall, and so eventually desiccation. It is interesting to think that in watching a hillman of Assam "*jhuming*" his land we may be watching an agricultural process which has had an incalculable effect on geography and human history."

This system of cultivation is by no means confined to India and it may very well be world-wide. It is believed to have been carried on by the Maya Indians in the Isthmus of Panama, 2,000 years ago, and is probably responsible for the erosion and desiccation of considerable areas of the surface of the earth.

3. *Progress in Forestry as a help to Agriculture in another country—Cyprus.*—In an article which lately appeared in the "Times" on the subject of Farmers and Forests, the writer in referring to the forests of Cyprus says:—

"These forests, famous for centuries, provided timber for Palestine in Biblical times, were used for the building of his fleets by Alexander the Great, and were so valuable a source of timber that Ptolemy, I, Soter, the first of the Macedonian Lagidae to reign as Pharaoh in Egypt, conquered the island expressly to possess them as he aspired to sea-power, just as Sultan Selim, the Sot, sent the unspeakable Mustapha to seize Cyprus some 19 centuries later because he wanted to drink its wine. The smelting of iron ore in Sussex is generally supposed to have broken the pride of the once mighty Forest of Anderida, in the same way the smelting of copper ore in Cyprus, begun under the Phoenicians and continued down to the time of the Romans, led to the denudation of large areas. Much still remained, and more than 1,000 years later King Richard found the island clothed with forest, the Lusignans were able to cut freely to provide timber for their splendid buildings, and as late as their last decade in the island, 1560-1570, the Venetians are said to have relied largely on Cyprus to supply the material for their galleys. Indeed, it is curious that, although their island produced the copper, the timber, the flax, and the hemp required for old-time shipping, the Cypriots were never celebrated as a seafaring race, or even as fishermen, and their maritime riches were generally exploited for the benefit of foreign conquerors, for even the Lusignans, under whom the island so long enjoyed independence and prosperity, were an outland dynasty supported by a dominant class of foreign origin, constantly recruited from abroad.

After the arrival of the British it was some time before the surviving forests, which had suffered much from neglect and from the wasteful methods of the peasants in clearing hill-land and cropping it until the rain had washed most of it away, and then repeating the process, were able to receive proper attention. In the first year for which the official expenditure on the forests is on record, 1880-81, only £156 was spent, and in 1884-85 the revenue was £1,134, and it was not until the early nineties that the laborious work of restoring the forests was properly taken in hand, for it was by then beginning to be realized that the forests alone could be relied upon to prevent the winter rains from being wasted. The rainfall is small—about 22 inch per annum is the average for the whole island—and it nearly all occurs in a comparatively short time. The Cypriot for centuries has seen the water which he so urgently needs for summer use rush destructively down the mountain watercourses, hurry past his farm perhaps tearing away a slice of his best land or depositing unwanted shingle and rubbish in its useless passage, in order to lose itself in the Famagusta marshes or in the sea.

Where the forests survive, or have been restored, much of the rainfall gets a chance of soaking in, to reappear in the springs later in the year, and now the department has begun to terrace the hills across rain-scored clearings or on barren slopes in such a way that the terraces slope gently inward towards the mountain, and thus, when planted, retain the rainfall which, before the terraces were made, would have run destructively to waste without more ado.

This naturally is an expensive process, costing about £30 an acre, but it acts as a most efficient check on further local erosion and saves good land on lower levels from being overwhelmed under spate-borne spoil and detritus. In this way it is hoped that the restored forests will gradually form a natural reservoir for the retention of the mountain rains, which are much heavier than in the plains (one hill-station registered 61 inches in 1925) and preserve the water for summer distribution; for experience has shown that ordinary dams are of little use on these torrents as they so soon get filled with silt. So long-sighted a policy naturally requires a good deal of time to mature, although in Cyprus trees grow with satisfactory rapidity, and meanwhile the department is busy with work of immediate and everyday utility. From special plantations of quickly-growing trees, as well as from forest growths which have reached their prime, it supplies fire-wood for the whole Island at the rate of 38 s. a ton cut and delivered to the door; and through its own stores it sells timber for building at reasonable prices. It provides too wild-olive seedlings for free distribution and subsequent cultivation and grafting; takes charge, when asked to do so, of privately owned woodlands; and co-operates with various public authorities in planting trees for ornament, for firewood or other forms of utility outside the forest areas, with a most beneficial effect upon the health, amenity, and appearance of the Island. Since the department, began to function it has spent over £684,000 in rehabilitating a wasting asset, and has drawn just under £600,000 in revenue from its forests which have, at a net cost of about £85,000, been increased tenfold in actual timber value, from an estimated £200,000 to at least £2,000,000."

What the Forest Department is doing in India for the Agriculturist.—The following extract from Volume VI of the series "India of To-day"—

entitled "India's Forest Wealth" by E. A. Smythies, B.A., Conservator of Forests (Oxford University Press) will give some idea of what forests mean to-day to the Agriculturist in India:—"An overwhelming proportion of the population of India is dependent on agriculture for its maintenance, and one of the most important aspects of forest management is to meet the requirements of the agricultural population. Among the peasant's greatest needs are firewood to replace manure, small timber for houses and wood for implements, as well as grazing and fodder for his cattle. It has been recognized with increasing clearness that forestry is an important vocation as the handmaid of agriculture. The importance of this aspect of forestry naturally varies considerably in different Provinces. In areas of comparatively sparse population and extensive forests such as parts of Burma, Assam or the Western Ghats, the pressure on the forests is almost negligible, and the requirements of agriculture are limited and met with ease. But in other areas, notably in parts of the Himalayas, in Kumaon and the Punjab, in parts of the Central Provinces and the Deccan, and elsewhere, the absolute possibility and existence of agriculture is intimately dependent on an adequate forest area in the vicinity. The comparatively poor and infertile soils cannot produce sufficient crops to support the population, who are compelled to eke out a precarious existence by heavy manuring with forest humus, by trading in cattle, sheep, or goats which graze and multiply in and through the forest, by earning wages in forest industries or by other means. And as the population increases the pressure and demand on the existing forest areas also rapidly increases, and a perpetual struggle results in trying to meet the urgent needs of the surrounding villagers and in trying to keep in existence an adequate area of forest to meet future needs. And in other areas again, notably in those less fertile parts of the densely populated plains of the United Provinces and the Punjab, where cultivation is somewhat precarious and where forest lands no longer exist, the pitiable economic condition of the people, the miserable mud hovels in which they live, the debased breed of half-starved cattle which they possess, the burning of stable manure as fuel instead of using it for enriching and manuring their fields—these and other unfortunate results must to some extent at least be ascribed to the complete absence of forest in the vicinity, and to the fact that the purchase price of essential forest products is thereby raised beyond the reach of the inhabitants.

In the legal process of reservation of Government forests and waste lands, the chief and most arduous duty of the reservation or settlement officer is the recording of claims of all the surrounding villages for forest produce, for timber, fuel, grass and grazing, leaf litter and humus, for rights of water and rights of way, for bamboos and edible fruits, and a score of other requirements. When the settlement officer has passed final orders allowing all legitimate claims for the *bona fide* and agricultural use of right-holding and concessionist villages, these demands have the first claim on the produce of the forest area, even up to the maximum output of the area, and as such rights and concessions are usually supplied free (but occasionally at reduced rates) it frequently happens that blocks of Government forest are managed entirely for the benefit of the adjoining villages, without hope or expectation of any direct profit or commercial exploitation. A few figures may be cited to illustrate how intimately the well being of the agricultural and village populations of India are bound up with the forests. (Figures given below refer to British India only, excluding Indian States, and for the year 1920-21). The total number of animals permitted to graze in Government forests was 12 millions, of which 2·8 millions paid fees (even full grazing fees are almost nominal, varying generally from 2 annas to Rs. 2 per annum per animal), 3·7 millions grazed at half rates, and 5·5 millions grazed free. The value of free grazing and fodder grass is put at 3·8 million rupees.

Right-holders and concessionist villages were given free of cost about five million cubic feet of timber and seventy-six million cubic feet of firewood,

while the value of a hundred other forms of minor forest produce, such as edible fruits and flowers, fibres for ropes, grass for thatching, bamboos, gum, resins, dye and tan materials, etc., is put at one million rupees, although this is probably far below the real value, since no accurate record is kept of these petty demands. The total value of rights and concessions given away to villagers every year from the forests of British India under the control of the Forest Department must be put at nearly £1,000,000 sterling, despite the extremely low rates at which these concessions are rated. This is an item which never appears in the statistics of financial results of the working of Indian forests. Admittedly a certain proportion of this produce has no commercial or sale value, i.e., it could not be sold elsewhere if the adjoining villages were not in existence; but on the other hand the actual value to the villagers, to whom the produce is given, is incalculable, since in many cases the very existence and economic life of the village is so intimately connected with the assistance to its life and agriculture, provided directly or indirectly by the adjoining forests.

The importance of forests in supplying grazing and grass for cattle kept for manure and for ploughing has been mentioned above, but two further points must be emphasised. An important article of food both for the agricultural and urban population is *ghi* or clarified butter, and the *ghi* industry is very closely connected with adequate grazing grounds within the borders of the Government forests. For example in the moist Tarai tracts along the submontane belt at the foot of the Himalayas, great herds of buffaloes are kept, which roam over the extensive areas of grass lands, and it is on the existence of this never failing supply of grass and fodder that the extensive export of *ghi* from the submontane belt to the crowded cities of the plains depends. From these same areas also a steady stream of young buffaloes and cattle are exported to supplement the agricultural resources of the adjoining districts to a distance of two hundred miles or more, and the support of this cattle-breeding industry is a further important function of the Indian forests. India is unfortunately and periodically afflicted with a failure of the monsoon rains, and in those years of famine, when the food and fodder crops fail and the very indifferent village grazing grounds fail to produce grass, it is a piteous sight to see the starving cattle wandering forlornly over the burnt-up plains or lying down by the wayside to die, with the vultures gathering to their ill-omened meal. It is then that the forest areas are heavily tapped to supply vast quantities of fodder grasses which are exported to the famine stricken districts. The importance of these practically inexhaustible reserve supplies of fodder in times of famine cannot be exaggerated. To the poor peasant the loss of his cattle by hunger and famine is an overwhelming blow, for without cattle he can neither plough nor manure, and even if he can raise the money by loan or mortgage to buy a fresh supply, after a bad fodder famine there are not sufficient cattle surviving to meet the demand. In the famine of 1918-19, in one part of one district of the United Provinces (in the Bah Tahsil of Agra), an inaccessible and inhospitable tract of barren and broken ravines, no less than 200,000 cattle of the agricultural classes were lost. There can be no doubt that the mortality amongst the cattle would be far greater in every serious fodder famine than it actually is, but for the reserve supplies of fodder available in the forests. These fodder reserves in the forests of the United Provinces, the Central Provinces, Central India, the Bombay Deccan, parts of Madras and elsewhere are in short a very important economic asset in India's forest wealth. It may be noted also that during the war, 50,000 tons of fodder grasses were collected in 1917-18 from Indian forests, to help the military operations in Egypt and Iraq. In times of famine and food shortage also, the edible fruits and roots and flowers that are available in forest tracts, and that help to eke out the inadequate food stocks of the people, are worthy of brief mention. There is another aspect of importance connected with forests in the general economy of the rural population. In all civilised countries of the world who work their forests intensively, the wages bill on the explai-

tation of forests and on forest industries is a big item, and as typified in many parts of America may be the dominant factor in the prosperity of whole districts. In India, perhaps more than in most countries, we find this to be the case, partly perhaps because the Indian population is so predominantly agricultural, and forest works can fit in so well with the slack periods in agriculture, partly because the relatively low standard of life and rate of wages has militated against the introduction of mechanical appliances, and the working of Indian forests usually makes a far higher demand for units of manual labour than corresponding work in other countries. To give one small illustration of this aspect; in the pine forests of Kumaon, the amount of money distributed every year amongst the local hillmen for the collection and export of crude resin (to feed the turpentine and resin distilleries) exceeds three lakhs of rupees (£20,000). This is not a very vast sum by the standards of international finance, but represents an asset of very considerable importance to the poor peasants of that tract, and in excess of the whole land revenue (or land tax) of the district where the resin collection is carried out. But in India, the influence of wages paid for forest exploitation usually spreads far beyond the confines or vicinity of the forests themselves. All the major tracts of primeval or virgin forest are necessarily largely uninhabited or very sparsely inhabited (their present existence is in fact due to their uninhabited nature), and very often the labour gangs required for their working have to be brought from far afield. To quote again an example from the submontane forest at the foot of the Himalayas, every railway and road is blocked biennially with sawyers, carters, carriers and every form of labour, first in their migration to the forests after the winter crops are sown in November, and again in their migration back to their homes in time for the harvest at the end of March. From the hills they come, from the far away plains of the Punjab, and the Ganges, and convert the great forests for a few months into a scene of intense bustle and activity and then again depart leaving the forests to the lonely fire-watcher and the roaming tiger, but the wages they have earned go with them to be spent in marriage festivals or to be converted into gold and silver trinkets. Again the great forests of the Andaman islands have to be worked entirely by imported labour, partly by the involuntary labour of the convict gangs of that great penal settlement, and latterly to some extent by Kachins from far away Burma. There is no use in multiplying examples, it is a feature common to most Indian forests, the great influx of labour working furiously for a while to render available for the industrial life of the country the valuable products of the forests, and then departing with their well-earned wages with the ripening of the fields to harvest, or when the terrific heats of summer or the tropical rains of the monsoon render further jungle work impossible.

Taking India as a whole, the proportion of forest land to total area (*i.e.*, 25 per cent.) is ample, but as has been indicated already, the distribution of forests is irregular, and while some Provinces such as Burma and Assam have more forests than they require or can work intensively, in other parts of India and notably in the Gangetic plain, and in the Punjab the area of forests is quite inadequate, and the rural population have to a considerable extent to carry on as best they can without forests. At the same time there are extensive areas of waste land which by skilful management are capable of being made into successful plantations, for the production of small timber, firewood, grass, etc., which have the double advantage of ameliorating the agricultural conditions of these treeless tracts and of putting to a profitable economic use lands which are otherwise barren and valueless. In a consideration of India's forest wealth, a brief account must be given of the very successful plantations which have been, and are being, created in certain parts of India where the demand for forest produce is keen, and where there are no natural forests to meet the demand. The best known examples which will be briefly described are: (1) the *babul* (*Acacia arabica*) and *sisu* (*Dalbergia sisu*) plantations of the Jumna and Chambal ravines in the United Provinces. (2) The irrigated *sisu* and mulberry (*Morus alba*) plantations of

Changa Manga near Lahore in the Punjab. (3) The Eucalyptus (*E. globulus*) plantations of the Nilgiris near Ootacamund in Madras."

Mr. Smythies goes on to give an account of the three examples of plantation work which he mentions and these descriptions will well repay perusal. One short quotation may be given here from the note on *Afforestation on the Jumna Chambal ravine tracts of the United Provinces*.—"In the untreated ravines, at the end of the monsoon rains, measurements showed that the moisture had penetrated a bare six inches, while in areas treated with an elaborate system of breaking up the surface soil, making small ridges and ditches and dams, moisture penetrated to 4 feet depth in the first year and to 9 feet depth in the second year, and resulted in a most luxuriant growth of valuable tree seedlings and fodder grasses, which automatically stopped further erosion. The results obtained have surpassed all expectations. In some of the more fertile patches, *sisso* (*Dalbergia sisso*) plants have attained 50 feet height in the six years from sowing; *babul* (*Acacia arabica*) seedlings reach four and five feet height in four months; in 1922 a thousand tons of good fodder grasses were obtained from about 5,000 acres of plantations. The ever-growing islands of vivid green and flourishing plantations in a sea of barren and aching desert afford as striking a contrast as can be found."

The Influence of Forests on Rainfall and storage of water in India.—The extent to which forests increase humidity and rainfall in a country and regulate the distribution of water has been the subject of many enquiries in India and in other countries. It is impossible to refer here at length to these matters, but in the publications, a list of which is attached to this note, will be found the results of many valuable observations. In Dr. Voelcker's report he notes, on page 30 (2nd Edition) as follows:—

"Taking all the months of the year except June, July and August (which are excluded because the rains of this period are not local in origin, but are those of the south-west monsoon and come from a distance), it was found that during the tree-less period 1870-4 there was a total of 374 rainy days only, whilst during the wooded period 1886-90 there were 416 rainy days. Further than this, it was ascertained that the character of the rainfall had altered within late years. Light and regular rain showers taking, to a great extent, the place of destructive occasional torrents. The agricultural importance of these facts is very great indeed."

I have obtained from the local forest officers data for more recent years and we now have the following figures:—

<i>Period.</i>	<i>Excluding June, July and August.</i>
1870-74	374 rainy days.
1886-90	416 " "
1902-06	467 " "
1918-22	481 " "

It thus seems clear that the number of rainy days at the Nilgiri Hills has increased with the increase of forests on those hills. On the 467 rainy days in 1902-06 the rainfall was 165 inches; on the 481 rainy days in 1918-22 the rainfall was 177 inches.

6. *General proposals for future action*.—I cannot do better under this head than draw particular attention to the report by Dr. Voelcker already referred to.

Dr. Voelcker was deputed by the Secretary of State to enquire into and advise upon (1) The improvement of Indian Agriculture by scientific means; (2) The improvement of Indian Agriculture generally. He arrived in India in December 1889, and, after a thorough investigation, submitted his

report which was discussed at an Agricultural Conference held at Simla in October 1890.

The report is of much value and must be so well known that it will be sufficient for my purpose, if I draw attention to the following:—

Recommendations, page 33	2nd edition.
Remarks on Green manuring, page 107	„
Recommendations, page 134	„
Destruction of Forests, page 135	„
Sir Dietrich Brandis' work, page 138	„
Forests, pages 140—166	„
Recommendations, page 167	„
Recommendations, page 189	„

It would be difficult to improve, in a general way, on the proposals set forth in Dr. Voelcker's report.

Proposals to increase the forest areas in British India.—There can be no doubt that the agricultural communities of India would benefit very greatly indeed by an extension of the forest areas. The general humidity and distribution of rain would be improved and the supply of water increased and regulated: timber and fuel would be available for the villager and he would be able to put cattle manure on his fields instead of burning it; the provision of good grazing and fodder would be increased.

It will probably be difficult to obtain the necessary funds for the establishment of these desirable forest areas from Provincial revenues, and it may therefore be considered whether it is not possible to provide for them by means of loans. As regards the management of these forest areas, it would appear advisable that this should, to begin with at any rate, be in the hands of the Forest Departments of the Provinces. Forest villages and panchayets have had a certain amount of success in some parts of India, but there is no doubt that for the present greater progress in the establishment and management of forests of the class required will be made if they are in the hands of experts and not in the hands of local bodies whose members are usually at present unable to realise the immense benefits that may ensue from continuous skilled management.

Replies to the Questionnaire.

QUESTION 19.—(a) Forest lands for the purposes of my answer may be divided into (1) Reserved Forest, (2) Village and unclassed forests.

(i) *Reserved Forests*.—I think that in a number of Provinces reserved forests could be made of more use to the villagers for agricultural purposes than they are at present. Wood for houses, fences, etc., and green manure and fodder could be made permanently available on a large scale than at present if it were found feasible to have them utilised in an economical and systematic manner. This is rarely possible at present because the habits of the ordinary peasant in such utilisation are extremely wasteful. He does not look ahead and will sacrifice the prospect of future benefits for present advantage. A change which would be desirable would be to have thoroughly reliable officials in charge of the forests, who would see that the produce was properly utilised. Inspection by gazetted officers of the methods of utilisation should be carried out frequently. The large size of forest divisions prevents this being done at present and at times reserves are closed because there is no one to supervise the extraction of the produce. The ordinary forest guard is of little use. Education of the agriculturist would help.

(ii) *Village and unclassed forests*.—Village forests are utilised by agriculturists under a certain amount of control but it has been found difficult to interest villagers sufficiently in the matter to ensure that the forests are cared for. Recently in the Punjab it has been necessary to take away the control from the villagers who made even a worse job of it than the forest subordinates. Panchayats have taken over the management of certain forests in Madras and are reported to be doing well. Progress in the management of these forests is to be found in the growth of public spirit and the spread of education. Unclassed forests are found principally in Burma where the agricultural problems in connection with forestry are not acute, as a rule.

(b) The supply of firewood and fodder in rural areas near forests can be increased in the manner suggested under (a) above.

In areas where there are no forests, I believe, that it would be a great advantage if land were acquired by the Forest Department for the formation of plantation.

(c) Deterioration of forests has led to soil erosion. Examples are the Punjab, the Himalayas, and the ravine areas in the south of the United Provinces.

The remedies are (1) control of grazing, (2) planting up.

(d) The methods by which the supply of moisture in the soil, the rainfall, and supply of canal water can be increased and regulated by afforestation and by the increased protection of forests so as to benefit agriculture are:—

- (1) Control of grazing.
- (2) Control of felling of trees.
- (3) Planting up.

Please see my note "Forestry and Agriculture in India" written for the Commission.

The same methods would be useful in preventing the destruction by erosion of agricultural land.

(e) Openings could undoubtedly be made for schemes of afforestation in the neighbourhood of villages.

(f) Many forests are suffering deterioration from excessive grazing, and soil erosion is thereby facilitated. $3\frac{1}{4}$ million of animals are estimated to have grazed in the forests of the Punjab during the year ending March 31, 1925. A few days' tour almost anywhere where there are forests in the Punjab will show what this means to the forest growth. Other Provinces which I believe suffer heavily are Bombay, Madras, the Central Provinces and the United Provinces.

The figures for the year ending March 31, 1925, are approximately:—

Punjab— $3\frac{1}{4}$ million animals grazed over 6,000 sq. miles.

United Provinces—1 million animals grazed over 5,000 sq. miles.

Central Provinces— $9\frac{1}{2}$ million animals grazed over 16,000 sq. miles.

Bombay— $2\frac{1}{2}$ million animals grazed over 12,000 sq. miles.

Madras—1 million animals grazed over 16,000 sq. miles.

The remedies are (1) reduction of the number of cattle kept by villagers, and (2) limitation of grazing to the amount that the forest can stand without deterioration.

Oral Evidence.

1906. *The Chairman*: Mr. Rodger, you are the Officiating Inspector General of Forests?—Yes.

1907. You have put in a memorandum of the evidence which you wish to give us, and the Commission have read that in conjunction with the previous memorandum which has been circulated as a separate Government paper to the Commission. I do not know whether at this stage you would like to make a statement, or would rather proceed by question and answer?—Well, if you question me on what you would like me to tell you, it will probably be easier. What I have to tell you will emerge in that way, I expect.

1908. I notice from your memorandum that you are fully alive to the importance of the services which it is within the power of the Forest Department to render to agriculture?—We are fully aware of that, yes.

1909. I have no desire to be critical, but will you tell me whether in the past those opportunities were fully realised by your service?—Yes, I think they were realised, but for many years past the establishment of the Forest Department has not been nearly as large as we should have liked it to have been, and we cannot manage forests with detailed care unless we have a large supervisory establishment. If we had had a trained establishment able to look after our small isolated forests, particularly those of interest to the agriculturists in the neighbourhood, we should have been able to do more for them than we have been able to do so far. As it is, in certain areas, our work has been, I think, to look after areas without being able to utilise them properly because we knew that if they were utilised without due care and inspection the material in them would be wasted.

1910. Do I understand from that that your attention is necessarily concentrated in the main upon forests which are not so important from the agricultural point of view as are some of the smaller and less valuable forests?—Yes.

1911. The main work of the superior establishment and the subordinates who work with them is mainly in the large important commercial forests, because in the past we have had to make revenue; the Forest Department has always been considered as a commercial department, and that is where our revenue comes from?—The revenue which may be realised from small scrub forests, grass forests and small areas available for cultivation is very small compared to the large revenue we get from the important timber forests.

1912. On the whole, you think that there is close touch and sympathetic understanding between the two services?—Yes, I have always found that. You will naturally understand, however, that the main and important blocks of forests are far removed from civilisation. Where there are fewer people we get larger areas. In a Province is very much broken up by cultivation, we find it impossible to reserve large blocks of forest, so that our most important and biggest forests are rather remote.

1913. Now, it is knowledge of the other man's business that makes for sympathetic understanding. I want you to tell me whether you think that all is being done that might be done to instruct your candidates and your junior officers in those things that forests can do for agriculture?—Well, I think probably we could do more than we were doing now to teach the forest officers and forest subordinates the needs of the villagers.

1914. Would you go so far as to say that a short examination paper on these questions might be included in the tests for appointment?—Well, sir, we do not examine them in forestry matters before they take the course in forestry.

1915. I will put in this way and say, at the appropriate moment?—If you do that, it will be a very excellent thing. In fact we should like to see that they have a useful knowledge of how they can help agriculture.

1916. You think that might be adopted?—Certainly.

1917. I see on the very first page of your "Replies to the Questionnaire" you say that it would be more easy to help agriculturists if the habits of the ordinary peasant in the utilisation of such opportunities (I paraphrase your words) made such assistance easy. What exactly do you mean by that?—I mean to say the ordinary peasant's way of using a tree is to cut it down at 3 or 4 feet from the ground and leave about three-fourths of it to rot in the jungle, and so the utilisation is almost invariably wasteful in forests.

1918. You have not the number of officers required to control the ryot?—That is the trouble. Our divisions are very large, and our officers are not able to see the forests which are near agricultural areas as often as they could wish.

1919. Do you think it might be possible to develop the Panchayat system (not for forest control) in the villages where rights and privileges are enjoyed and to control the way in which those rights and privileges are made use of?—It varies in different Provinces. We tried it in the Punjab, and we found that the village elders have been able to make less progress, and have incurred more dislike in managing the forests than the forest subordinates.

1920. That is so far as panchayet management of forest goes?—Yes.

1921. What I am asking you now is whether you do not think some control by panchayets over the ryots in their enjoyment of their privileges in forests controlled by you and not by panchayets might be useful?—You mean the panchayets should look after the enjoyment of the rights in the reserved forest?

1922. That is my idea?—No, I would not recommend that.

1923. I should like to have your reasons?—Because we find that expert control over these matters is more satisfactory than village control.

1924. I am sure it is, but you have just told me that you have not the number of officers required to exert it?—As far as we can do it, we open the forests and look after them. The ordinary village headman has not the understanding of the necessity of economical forest utilisation.

1925. You could not fix the responsibility on him and teach him?—He is not a very easy person to teach.

1926. You are probably familiar with Dr. Voelcker's report?—Yes.

1927. You know the view that he there puts down regarding the manner in which forest can assist agriculture?—Yes.

1928. You think sufficient attention has been paid to that advice?—No, I do not.

1929. Who do you think is responsible for that?—I suppose the Local Governments.

1930. Take first the provision of preserved fodder. Have you in your mind the possibility of any extension of a system whereby the Forest Department cuts and makes hay or silage?—It can be done. During the War several of the provinces where fodder is an important item cut and supplied very large quantities. Whenever there is any necessity such as the demand during the War or the demand during famines, the Forest Department has always been able to supply fodder on a very large scale.

1931. So really it is a question of an assured demand?—Yes. When necessary the Provinces have been able to supply it.

1932. In the main it should be regarded as an insurance against the loss of cattle during famine?—Yes.

1933. If there is no famine, is there a market for your fodder?—Yes.

1934. Even if there is no famine?—There is always a certain amount of demand for it.

1935. For preserved fodder?—There is always a market for baled fodder. There is always a good market for it, in Upper India at any rate.

1936. In non-famine years can you obtain a price for baled fodder which covers its cost of production?—I believe so.

1937. What then prevents the expansion to a large extent of this very important service?—In the ordinary forest we do not encourage grass land. We try to grow trees. In certain areas it is found that we can make more money and better forest revenue out of an area under grass land than under trees, but we would rather grow trees if we can, generally speaking, unless it was necessary for the agricultural needs of the community to have grass land.

1938. That is your business?—Yes.

1939. Are there important and considerable areas contiguous to important agricultural communities where fodder might be grown for baling and where fodder is not now being grown?—I do not think so.

1940. You point out in one of your memoranda that the percentage of forest land to cultivated land in India taken as a whole is sufficient?—Yes, but in some of the Provinces it is anything but sufficient.

1941. Its distribution is unsatisfactory?—Half of it is in Burma, to begin with.

1942. Do you contemplate the planting of further forests in the neighbourhood of agricultural land?—After a fairly thorough study of the subject I am convinced that we can do good to the districts by starting forests in them.

1943. That is to be taken as applying both to dry land and irrigated land?—Yes. We have now good irrigated plantations in the Punjab which are most valuable.

1944. You think you have discovered the best quick growing timber for the purpose of providing fuel?—Yes. I have noted down the names of about a dozen that we might try which we know will be suitable for planting in various parts of the country according to rainfall and temperature. The eucalyptus is a very important tree in the Nilgiris. It has a wonderful annual growth there.

1945. I am fairly familiar with the eucalyptus. What type are you thinking of?—They have several kinds. I do not remember the scientific names, but it is a wonderful timber tree, which has not, however, proved very satisfactory in Upper India up to date.

1946. Have you in mind a definite scheme of afforestation? Taking the Punjab, for example, have you in mind any definite scheme for afforestation there?—I have not been through the dry districts of the Punjab.

1947. About the irrigated?—I have not been through them either.

1948. Have you any definite schemes in your mind?—No. It should be done in every district where it is found possible to undertake some scheme of this nature. I would suggest that every district should be critically examined with a view to seeing what areas we can take up on which we can plant forests which will pay and be of general good to the district as compared with keeping the land under agriculture. It is not a matter where one can produce a scheme even for a Province. You would have to do it for the districts.

1949. I was going to ask you what steps you take to obtain the consent of the responsible authorities to the afforestation of a particular plot of land? How do you link in there with the provincial services?—In the United Provinces they have done it. With the consent of the landowners they have taken up a very considerable area of what we call barren ravine land and handed it over to the Forest Department.

1950. Who are "they"?—The Local Government. That is ravine land near the Jumna, land which has become barren owing to excessive grazing and erosion and the cutting of timber. Successful planting has been done there. I have seen that, and I think that a great deal may be done on those lines, especially on the barren lands in the south and south-west of the United Provinces.

1951. Do you think it would be a sound policy if in formulating the main outlines of development under irrigation in new areas a definite plan of afforestation under irrigation were settled upon in the initial stages?—To fix a percentage of the whole land to come under forest?

1952. Yes?—I should like to see that.

1953. I am thinking of a case where a desert is being irrigated, where the planting of canal colonies is contemplated and where there are no vested interests?—I should like to keep 15 or 20 or 25 per cent under forest if it is found possible.

1954. It is not a question of keeping it under forest but of putting it under forest?—At the time of creating the irrigated land?

1955. Yes. Do you think it could be shown that over a period of 50 years it would be a paying venture to take the steps you suggest?—Not everywhere. Sometimes you would only get 2 or 3 per cent. We cannot expect 7 per cent from afforestation. It is only in a few places that you will get a high percentage. 2 or 3 per cent could not be considered as a paying investment for Government money at present.

1956. It would be a doubtful step from the financial angle to hypothecate 15 or 20 per cent of your newly irrigated land to forest?—But then there is the general point of view of the good to the countryside.

1957. What do you mean by "good"?—Provision of fuel and grass and the effect upon the local climate of good tracts of woodland.

1958. You think those have an important economic bearing on the crops?—Yes.

1959. May I suggest to you that whereas the *prima facie* advantage may be 3 per cent the actual advantage cannot be estimated and may be much more important?—Yes.

1960. I am aware that the matter does not come within the immediate purview of your department, but are you interested at all in the culture of cinchona (quinine)?—I have talked the matter over with the men in charge. I have seen some of the work. I have had a little to do with it.

1961. Where?—In Burma.

1962. What department is at present carrying on that work?—It is under the officer who is Superintendent of the Botanical Survey of India. The officer in charge is called the Superintendent of the Botanical Survey of India and also Superintendent of Cinchona Cultivation, or some title like that.

1963. Is the culture of quinine intimately bound up with the presence of an appropriate growth of other varieties?—Colonel Gage used to be in charge of that. I have talked the matter over with him. He told me that they must have primeval forest if possible on the land before they can plant cinchona.

1964. Is the altitude important?—Apparently not so important, because they are planting it near Mergui in Lower Burma now, which is little above the sea, and they also plant it in Tavoy at an altitude of 800 to 900 ft.

1965. Do you think your department can undertake the development of cinchona plantations?—Yes, I think so.

1966. Do you think it would be a good thing if your department did so?—It is not right to say that another department is not doing it properly. I would not like to say that we could do it better until I see what is being done at present, but it seems to me the matter is intimately connected with forestry. Cinchona plantations are usually in forests.

1967. Now, a word or two about another subject, the grazing of cattle in forests. Are you satisfied with the system and the scale of fees charged?—I think that in the majority of Provinces the scale of fees charged is nothing like what the grazing is really worth. The Bombay Government in their note say that they have sacrificed about 12 out of 20 lakhs, some very large sum, which was really the value of the grazing. The fees are almost always

reduced to a small sum. The Central Provinces Government are insistent on the point that the villagers in the neighbourhood should have the utilisation of their own natural resources at a reasonable rate.

1968. Is there sufficient grazing opportunity for the total cattle population?—No, nothing like what is required, in Upper India. There are far more cattle than the forests can support.

1969. Would you go so far as to say far more cattle within easy reach of forests than can be grazed in those forests?—Yes.

1970. Do you think that the charging of a higher scale of fees would tend to confine grazing to better animals to the advantage of agriculture as a whole?—What we want to get at is to reduce the large herds of cattle of very poor quality and it is very doubtful if that can be done. I am rather afraid just a few animals would be put into good grazing in the forests and others would be left to pick what they could, as happened in famine years when many thousands of them died.

1971. You mean the effect of a general high rate would be to reduce the numbers?—I suppose it would cause a good many deaths; I do not know whether it would succeed in improving the breed. I do not advocate the increasing of the rates.

1972. That has been suggested from one quarter. If forests were within the terms of reference of the Commission I should have many other questions to ask you, but they are not, and we are only interested in matters where forestry administration touches agricultural interests?—Yes.

1973. *Dr. Hyder*: The policy for the Forest Department is laid down in a circular* of the Government of India which was issued in 1894, in which it was said that, subject to certain restrictions, the claims of cultivators are stronger than the claims of forest reservation. Does your department still adhere to that policy?—Certainly.

1974. And there have been no changes?—No, as far as I know. Generally speaking, we adhere to it. It is in our Code and every forest officer has a copy of the circular and knows it.

1975. Why is there then this complaint on the part of agriculturists in the neighbourhood of forests that their facilities for grazing and other matters have been reduced?—Because, as I noted in the beginning of my memorandum, in the old days the agriculturist was accustomed to use the forests as he was accustomed to use the water and air and sunshine, and now, with an increasing population and increasing utilisation, that is not possible. If you allow them to do that, the forest will be destroyed in a very few years, as they have been in many parts of India.

1976. Coming to this question of grazing of animals, do you think all animals are equally destructive of forest growth and young plants?—No.

1977. Do you then make any discrimination in favour of some animals as against others?—Yes.

1978. Does your department, or do the provincial departments, keep out certain animals, for instance, goats and sheep and camels, and allow grazing facilities to a larger extent in the case of cows and bullocks?—Yes.

1979. Because the latter are evidently not very destructive?—They are not so destructive. A goat will climb a tree to eat it and a cow cannot do that.

1980. A cow will not eat young shoots?—Yes, it will eat the tender shoots of a great many trees, and game also eat a lot.

1981. Have any experiments been made as regards the plantation of young plants for the purpose of fuel?—Many.

1982. Has anything of that kind been done in the United Provinces as regards for instance, *Casuarina*?—I have not seen *Casuarina* in the United Provinces. They have it in Bombay and Madras.

* Circular No. 22F., 19th October 1894, Department of Revenue and Agriculture.

1983. You think the climatic conditions in the United Provinces are not suitable?—Generally speaking, I think, *Casuarina* grows best near the sea shore. It also grows in Central India to a certain extent. It is a good fuel wood and might be tried.

1984. You think that would be suitable for villages?—Yes, that is one of the trees that might be tried.

1985. Coming to these figures you have given in your memorandum, I notice a very great discrepancy as regards the animals which graze. In the United Provinces, for an area of 5,000 square miles the number is only one million, and if you compare the area with the areas in other Provinces, you will find the number of animals is much larger in other Provinces. Why is there this difference?—You are talking about forest grazing. Numbers of districts in the United Provinces have no forests at all. There is no forest officer there and we have nothing to do with them.

1986. But the total area is 5,000 square miles. In the case of the Punjab you have 6,000 square miles and the number of animals that graze there is 3,250,000. In the case of the United Provinces there is only one million. Do you think you are tightening up forest control in the United Provinces?—I suppose people in the Punjab keep larger herds.

1987. Could I draw that inference from the total animal population of the United Provinces and the Punjab?—I do not know, I am sure.

1988. *Sir Thomas Middleton*: From the point of view of grazing, there are three classes of forests, first of all the forests in which grazing is freely allowed, second, the forest in which grazing is not allowed but grass-cutting is allowed, and thirdly the forests in which neither grazing nor grass-cutting exists. Are there any figures which would enable us to ascertain the approximate areas of these three groups either for India as a whole or for Provinces?

Mr. Calvert: I have the figures for the Punjab.

The Witness: I do not know; I would have to look that up.

1989. *Sir Thomas Middleton*: Could you, without looking up figures, give us a very rough idea as to the relative proportion? Would the open forests amount to 10 per cent of the whole?—We have in one of our annual forms the areas closed and open to grazing, and these are divided into those closed to animals for part of the year and closed to animals for the whole year.

1990. Would it be possible, without much trouble, to get some information showing for the different Provinces approximately the area open to grazing?—I will give it to you now; I think this is what you want. (*Document* handed in.*)

1991. The next point is as to the method of grazing. When you open forests you open them for a specified period of a year or the whole season. You have two classes of forests?—Yes.

1992. Is there any rule that when the forest is open, it shall be grazed in sections, or is the whole area thrown open for the season for which grazing is permitted?—In a few cases they try to do that, but if you had much to do with village-grazing you would see that detailed control of that kind is almost impossible.

1993. I have seen a good deal of it and I know the difficulties, what I want to know is whether there has been any attempt to regulate grazing?—There has been.

1994. I was sorry to hear that in answering Dr. Hyder you classed the sheep with the goats in grazing regulations?—It was Dr. Hyder who did that.

1995. *Dr. Hyder*: May I point out to you that in this statement which you have given, you class camels, sheep and goats as browsers and you give greater facilities to other animals than to these?—Yes.

1996. *Sir Thomas Middleton*: Would you agree that the sheep might be a desirable animal to include along with cattle?—I would say the goat was much the worst.

1997. *The Chairman*: Have you ever seen a sheep up a tree?—No, but I have seen a goat up a tree.

1998. *Sir Thomas Middleton*: You agree with the Chairman that some examination as to the requirements of the agriculturists would be desirable for forest officers. When would you propose to examine them, before appointment or after appointment?—I do not think that is the point. The thing is to teach them, not to give them an examination. After they have had a short series of lectures on the utilisation of forests for agriculturists and villagers I would give them an examination, after their forest course.

1999. *The Chairman*: I had hoped that I had persuaded the witness that an examination at some stage might be of use because it stimulates interest?—Quite so.

2000. *Sir Thomas Middleton*: I asked with the object of getting an opinion as to when that examination should come?—We examine them in general subjects only, before they start their forest course.

2001. Personally I should hope you would not attempt to examine them on agriculture before entrance to the service?—No.

2002. In those forests in which grass-cutting is common and which are not grazed, is any attempt being made to build up reserves against famine years? Do you store for more than two seasons?—Experimental work on these lines is now being carried out to see to what extent baled grass can be kept in small houses and depôts in the forests.

2003. You mentioned that you possessed a list of trees which in your opinion would be of value for fuel purposes. In order that we may get the names perhaps you will read out your list?—I have put down two small heads; one is for woods which would be useful to people for agricultural implements, for fences and house-building, and the other for fuel. I have got the Indian names and I can tell you the scientific names.

2004. Give us the Indian names*?—*Babul, Khair, Haldru, Kokko, Kakli, Dak, Careya, Amaltas, Shisham, Gumhar, Lagerstroemias, Champak, Odina, Kosum, Teak, Sain, Ber, Simul, Toon and Jaman.*

2005. You would perhaps send in the scientific names*?—I will. There are possibilities for planting for agricultural implements and fuel.

2006. *Sir Ganga Ram*: I have heard all these names. I know only about *Babul*. But it casts a very injurious shadow over the crop and is therefore unsuited to grow on the edge of the fields?—Yes.

2007. Can you give us the name of any tree which will not cast any injurious shadow over the crop and could be grown on the edge of the fields?—If the crop does not want any shadow, I do not know any tree that would not cast a shadow.

2008. An injurious shadow, I am referring to?—I think *Acacias* will do little harm.

The Chairman: There is nothing lethal in the shadow; it is the size of it that matters.

2009. *Sir Ganga Ram*: You have been in the Punjab and you have seen the Chenab colony?—No, I have not seen that.

2010. Sometime ago at the suggestion of the late Commissioner Mr. Booth Tucker I planted *Rheudus* and *Eustraka* trees. They grew about 30 feet high in three years and by cutting one of them and allowing it to dry I got 1 maund and 29 seers of fuel. Those trees are still in my village. If the Commission goes to my village I shall show them. They do not cast any injurious shadow, because they have no shadow; they are not very leafy. Do you know anything about those trees?—They are kinds of eucalyptus. I know a little about them. They are not easy to grow.

* For revised list of trees with the Indian and scientific names, vide Appendix, page 274 (ii).

2011. They grew a tremendous size in three years. I had 5 of them?—That is garden work, not forestry, is it not?

2012. Would you kindly define 'reserved forests'? In reserved forests do you have new trees or are they forests which contain trees of olden times?—The majority of reserved forests in India and Burma are taken up from primeval jungle.

2013. If you have old trees there and you do nothing there, what is your objection to allow free grazing there?—If there are plenty of old trees, there is no grazing. Lots of old forests have no grass in them.

2014. You have no objection to allow grazing there?—Yes, we have, because cattle destroy the young trees which are coming up to take the place of the old ones.

2015. The old trees are very high, beyond the reach of cattle. What is your objection to allowing free grazing there?—When the old trees are mature, they must be felled and sold.

2016. There are hundreds and thousands of forests where there are old trees. You require time to cut them?—We do not mind grazing there, but if we are going to start felling and planting we should object.

2017. You mention in your memorandum the process of terracing inwards towards the hill side. Why do not you carry that still further and then allow the people to cultivate?—You cannot make cultivation there. The land is too steep. We have not got far enough for that. If the people want to cultivate in these forests, they will cut down all the trees that we have planted there.

2018. In this connection you have not seen my article in *Indian Engineering*, I take it. I will give you a reprint of it now. You admit in your memorandum that floods are due to the too precipitate discharge of rainfall?—Yes.

2019. Why do not you carry out the system, to which I have alluded, on a large scale, so that floods may not cause so much damage?—We do wherever we get a chance.

2020. Do you want special funds for this if this idea is to be carried out on a large scale?—We should need special funds.

2021. Could not that terracing inwards be done in the Khyber hills?—I suppose it could. I have not seen the Khyber. I understand it is very barren and rocky.

2022. Terracing inwards will make some grass grow there and provide livelihood to those restless people who commit so much crime?—Yes, it sounds a very good idea.

2023. I hope to show that to the Commission when we go to Peshawar. One more question. Do you allow the leaves which fall from the Pine and Deodar trees to be taken by the neighbouring zamindars? Have you any objection to the neighbouring zamindars taking them away?—I believe they do take them to a great extent.

2024. They are prevented by the Forest Department. Zamindars have complained to me that they are not allowed to take them. I have told them they are good as manure, but they tell me they are not allowed to take them away?—If you take these things away from the forest soil for many years running, it becomes very much impoverished, and your next crop of trees will certainly be inferior.

2025. If a zamindar wanted to plant walnut trees, would you be prepared to give him saplings?—We always do that.

2026. You said in reply to the Chairman that you kept baled fodder. How do you bale it?—We have some machines, the same as are used for *barbar* grass.

2027. Hand-driven?—I have not seen anything done by machine. I believe in War time in Bombay they did use steam, but I do not think it is used as a rule in the forest.

2028. You are aware of the fact that in the Chenab Colony, under the rules they kept 10 per cent reserve for *chirag* and other purposes; for years they did nothing because neither could they get any assistance from the Forest Department nor could they get any from the Irrigation Department, they would not give any water; and the result is that this year our Governor has reduced the area from 10 to 5 per cent and made a crore of rupees by selling land. Do you think the Forest Department could help the zamindars in any way if the Irrigation Department gives water? These are very important fuel reserves for the villages. When these colonies were established, each village, supposing it had 65 squares of land, kept one sixth for fuel and for grazing purposes. For 20 years they did nothing about it because the Irrigation Department was so unkind as not to give any water for it and the zamindar would not give his own water and the Forest Department paid no attention to them, and so it is now reduced to 5 per cent. Even 5 per cent is good enough if the Forest Department will guide them how to plant trees or anything of that sort for fuel. I understand the Irrigation Department is willing to give water for it?—I am certain they would.

I only ask that a note may be taken of that.

2029. *Sir Henry Lawrence*: You have told us that the great majority of your forests are remote from habitations and population?—Comparatively so, yes.

2030. Could you give us any idea of the total amount which is available for assistance to agriculturists? You have some 220,000 sq. miles altogether. What percentage of that is within easy reach of agricultural habitation? Could you give us any sort of figure?—Generally speaking, the reserved forests are the more remote, the protected and unclassified forests are nearer the cultivator; our areas for that are 104,000 sq. miles of reserved, 8,000 sq. miles of protected, and 120,000 sq. miles of unclassified. That is a very rough classification; but if you wish to have more detailed figures I could get them worked out.

2031. Nine-tenths of the unclassified is in Burma?—That is quite true.

2032. I mean that is not a fair distribution?—The figures I have given are for the whole of India; I could get the detailed figures for you probably in a few days. It would probably be more useful than any estimate I could give you now.

2033. Would you accept the statement as regards Bombay that not more than one-third of the forests in Bombay is within reach of the agricultural population?—I fancy that is about right.

2034. For instance, taking Kanara District which has 5,000 square miles and has a population of 600,000 or Khandesh and the Panch Mahals which have 3,000 square miles and a population of less than a million, the remainder is about 4,000 square miles which could be utilised for agricultural purposes, or a third of the total area in Bombay. Is that a fair statement? And would it be applicable to most Provinces?—That could be utilised for agricultural purposes?

2035. Yes. Will you think it out and give us some figure?—Yes. Do I understand that you include *jhuming* or temporary hill cultivation for agricultural purposes? To our ideas it is an illegitimate form of cultivation.

2036. I would not include that as being legitimate assistance to permanent agriculture. I mean in the way of grazing or providing fuel or minor woods for implements and such purposes. You mentioned *jhuming* or hill cultivation: do you take that as an important factor in forest policy throughout India?—Yes, in the wilder tracts.

2037. It may be so in Bombay, but does the same problem exist elsewhere?—In Assam and Madras and in a good many other places, I think.

2038. We call it *kumri* in Bombay; but it refers only to a minute percentage of our forests?—Yes.

2039. In your printed memorandum here the statement is made that the value of free grazing and fodder grass was put at 3·8 million rupees. Is not that a very great under-estimate?—We never put any great value on these figures of free produce from the forests; the figures are obtained through headmen's statements.

2040. It works out at less than eight annas per head per annum?—It may be much more; in many districts it is certain to be much more; the way in which these figures relating to free grazing and fodder grass are collected convinces us that in a good many cases the figures are quite unreliable; but we must put down something; we do not pretend the figures are accurate; they can never be accurate.

2041. It may be said against the department that you do not do enough for free grazing and fodder grass, if you put down 38 lakhs for all-India or 8 annas per head per annum?—I have got here the estimated figure for the year 1924-25, which is 67 lakhs.

2042. Even that would be only a rupee per annum?—Yes.

2043. That is rather on the low side?—Yes; it might be a hundred lakhs.

2044. In regard to the baling of grass you are not perhaps acquainted with the experiments which have been made in Bombay where machinery is used for baling grass?—I have heard of it.

2045. Baled grass has been kept for the last ten years; it is not a perfectly new experiment?—No.

2046. But the grass that is available for baling is of very poor quality?—Yes.

2047. Naturally, because it grows on such poor soil and under high forest?—Yes.

2048. You spoke of cinchona. What would be your estimate of the total area that should be put under cinchona in order to fulfil the requirements of India? Would it be any very large area?—I imagine it would be some thousands of acres.

2049. Not a large proportion of your forest area?—No. But a large portion of our forest area is quite unsuitable to grow cinchona.

2050. The area under cinchona at present is about 3,000 acres?—Yes.

2051. If you multiply it by ten you would fulfil the requirements of India?—I do not think so; you would probably want more than that. I believe at present a large quantity of bark is being bought to meet the deficiency in India.

2052. Would a hundred thousand acres suffice?—I could not tell you off-hand, but I should say that it would be enough.

2053. What I want to know is whether it is an undertaking of such dimensions that it should frighten the Government of India from proceeding with it?—Certainly not, it ought not to be.

2054. *The Raja of Parlakimedi*: In addition to the methods for supervision you suggested, what do you think of introducing a system of doing the work of distribution among the ryots for their domestic purposes by some sort of token system in the hands of village headmen?—It can be done, but it does need a great deal of supervision. We have found in certain cases that the village headmen will take advantage of it for their own purposes. That has happened in the Jhelum district of the Punjab already and in the annual report it is said that they decided to take forests away from the villagers in the Jhelum district and give them back to the Forest Department. In Madras I believe they have started the Panchayat system and it is working well, but it is only a very recent experiment and one cannot base very much on it yet.

2055. As regards protection of grazing land, would it not be better if the department did it by rotation?—That has been mentioned already, and I have stated that it has been done to a small extent in some places already; but

it needs a great deal of careful supervision and in many cases you need to fence, which is an expensive matter; the cattle stray a good deal.

2056. Could not that be entrusted to the village headmen? Can they not be held responsible?—They can be held responsible, but what the results are is another matter.

2057. It has not been experimented?—It has been experimented within what are called the Hazara village lands to a certain extent, I believe.

2058. Sandal wood is very much affected by some sort of borer?—Spike.

2059. Are any steps being taken to protect it against spike?—It is not a matter of protection; it is a matter of finding out what it is caused by; as far as I know we have not found yet what the cause is; a great many scientists have been at work to find it, but have not succeeded yet; the experiments are still going on.

2060. Sandal wood does not require any elevation for growing?—It will grow at a height of 2,200 feet and flourish at that height. Mysore and those parts grow a great deal of it.

2061. *Sir James MacKenna*: I want to put a few questions from rather a different aspect than that of my colleagues. What is the policy of the Government of India with reference to Indianisation of the superior grades of the Forest Service?—The policy of the Government of India is to have 75 per cent of Indians in the Indian Forest Service.

2062. Am I correct in saying that the Forest Department is the first Department in India seriously to take up the training of Indians for these superior courses?—I fancy so, yes, as far as I am aware.

2063. How long has your scheme for this training been running?—We opened the first course on November 5th of this year.

2064. So that you are not yet in a position to give an opinion as to its success?—No.

2065. What was your opinion of the first group of candidates who came up before the Selection Board for admission to this advanced course?—Half of them we decided were not suitable.

2066. On what ground, physical or educational?—We had various headings; we divided up our notes into headings; the three of us marked the points separately: appearance and manners, English, intelligence and so on, and we found that we were practically unanimous in our judgment of the various candidates.

2067. What was the composition of the Board?—Mr. Richey, the Educational Commissioner, Dr. Ziauddin, Vice-Chancellor of the Aligarh University, and myself.

2068. Then as we shall probably have to consider the problem of higher education of Indians for the Agricultural Service, do you think that a visit to the Dehra Dun Institute by the Commission, if it can be arranged, will be helpful?—I think it will be a most excellent thing.

2069. That will probably be when we tour the United Provinces?—Yes; it is very little out of the way.

2070. There is only one forest question I want to ask: *Kans* is a very big problem in the Forest Department?—In Southern India.

2071. Is that prejudicial to agriculture as well as to the forests?—I believe it is bad when it gets on to a place used for cultivation.

2072. That is a problem which you must tackle both in the interests of forests and of agriculture?—Yes.

2073. *Prof. Gangulee*: With regard to reserved forests, do you record the claims and requirements of all the surrounding villages?—Before an area is reserved, the most minute inquiry is made about the claims of all the surrounding villages, and any man who can possibly have any claims has them recorded; in fact, even if he walks through the forest, he is allowed to do it, and his claims are always recorded.

2074. In answer to the Chairman regarding the habits of the ordinary peasants, will you kindly explain what habits you have in mind? I am not quite clear what you mean when you refer to the habits of the ordinary peasants?—You are aware that in Upper India a good deal of lopping is done. Many trees such as Elm, Chestnut and Maple have been killed in the Himalayas by people lopping the branches off.

2075. That indicates scarcity of fuel, does it not? They are driven to do that because of scarcity of fuel?—This is for fodder. The point is that there are too many cattle. If there were half the number of cattle, they would not need so much fodder.

2076. You ascribe the lack of fodder to the habits of the peasants?—They keep more cattle than their village tract can support.

2077. Do you suggest that at present the cattle population is excessive in our villages?—I should think so, in a good many villages.

2078. In order to remedy those habits, you suggest that there should be officials in charge of forests. I am not quite clear in my mind what definite steps these officials would take in order to bring about this change?—The ordinary Divisional Forest Officer has got a very large area under his jurisdiction, perhaps a thousand square miles of reserve, and he cannot be sure that his Ranger, Deputy Ranger and Forest Guards are looking after the interests of the neighbouring people in the best way, whereas if he goes round himself and the villagers come to him, they say that they are not getting the produce they want when the subordinate officials are in charge, and if the Divisional Forest Officer or the Assistant Conservator of Forests go round they see that the villagers get more.

2079. Then you think that if you educate the agriculturists it would be a great help in this matter?—I suppose it would be a certain extent.

2080. Do you carry on any propaganda?—We have been trying to get a scheme up, but we have not got the funds to carry on the propaganda. Propaganda costs a good deal of money. We do publish a great deal of forest literature and that is circulated all over India, and large numbers of people read it.

2081. Referring to the Punjab, you said that it was necessary to take away the control from the villagers. But was there any systematic attempt made by your department to convince these villagers that proper forest management would be to their interest?—Yes, I believe there was a great deal of trouble taken by the officers of the Punjab Forest Department, and it was found that the villagers themselves unanimously desired that this experimental control should be taken away from their own people and that the control should be put back into the hands of the Forest Department.

2082. Could you tell us if the supply of firewood has really replaced cowdung to any large extent?—In the United Provinces, in some parts of Central Provinces and the Punjab, I do not think it has so far. You see, carriage costs a great deal and we have not got the wood near enough to the man who wishes to burn it.

2083. With regard to the question of the land acquired by the Forest Department for the formation of plantations, do you think that a good deal of suitable land is available in the Provinces for the purposes of afforestation?—I have no doubt that, looking to the good of the village tract or district, on the whole, we could get suitable land in most districts.

2084. For instance, in Bengal do you think there is sufficient land?—I do not know much about Bengal.

2085. You agree with me that the question of soil erosion is very important. Are you in touch with the agricultural research institutes in investigating the factors that are responsible for soil erosion?—Do you mean personally?

2086. No, I mean the Forest Department as a department. Does your department present this problem to the agricultural research institutes to

see what are the factors responsible for soil erosion?—I am not aware whether this has been done.

2087. With regard to afforestation, again, which, I think, is very important, do you think any definite progress is being made in this direction?—Not enough.

2088. The reason being that the provincial departments are slack or they have not got the necessary staff?—I will not say they are slack, but it is rather a big thing to put down money to acquire decent tracts of land for forest.

2089. Then the difficulty is to secure proper land?—It is always difficult to get land in India, is it not?

2090. You do not think there is any possibility of further extension?—I think there are great possibilities if the question is taken up. Speaking as a Forest Officer, I should like to see the forest areas increased in quite a number of districts.

2091. Do you have forest nurseries in India?—Yes.

2092. How many nurseries have you in this country?—There are numerous small nurseries all over the country. They must be local.

2093. From the point of view of flood prevention, you consider that afforestation is most important?—Yes, most important.

2094. Is there any possibility of extending the manufacture of forest products in India, resin and things of that kind?—Resin is going ahead as fast as it can. It is a very flourishing industry in the Punjab and in the United Provinces the industry has been brought up to date by scientific means.

2095. Are you able to secure the necessary labour?—In most parts we get all the labour required. I have just been through Hazara, and we do get villagers for work. They get a nice little sum in cash.

2096. That gives them an opportunity of getting a subsidiary income?—Yes.

2097. You suggest, which is very interesting, that the work might be extended by a provincial loan?—Yes, the profit of the Forest Department last year was about one and a half million pounds, and it goes to the Provinces. They are, however, very reluctant as a rule to part with any large sums for things of this kind.

2098. Therefore, if the Government of India adopt a definite policy of extension of forestry, they will have to depend on loans?—They will have to depend on provincial goodwill, first of all.

2099. With regard to the management, you think it should be in the hands of the Forest Departments of the Provinces; you do not think there will be any necessity for direction from the Central Government?—It is not necessary, because the Provinces are quite capable of carrying on the work by themselves.

2100. Independently of any stimulus?—Well, stimulus is good for everybody, but they are quite capable of doing it.

2101. With regard to the problem of education on forestry, do you emphasise the agricultural aspects of forestry in your college curricula in Dehra Dun?—We emphasise it in this manner, that the rights and privileges belonging to or enjoyed by villagers in the neighbouring forests are a most important consideration on which great stress is laid. The students are fully instructed in those things. We also teach them the importance of forest denudation, the erosion of hills and so on.

2102. Also about the composition of fodder?—Yes, the use of grass is taught.

2103. *Mr. Calvert:* Have you read one of the essays of Elia on a new method of roasting pig?—Yes.

2104. Is not that typical of the average point of view in the villages towards the forests?—Yes.

2105. In your "Replies to the Questionnaire" you mention the experiment carried out in the Punjab. Was it made in the Kangra district?—Jhelum, I think. I can show you the Report if you like.

2106. In the last Administration Report of the Punjab it was stated that out of 6,700 square miles under the Forest Department in only 150 square miles was there neither grass-cutting nor grazing. Does not that furnish a complete answer to all charges of lack of consideration to agriculturists?—I think so.

2107. You suggest an extension of forest plantations on the Punjab system, but is it not a fact that there is sometimes an excess of fuel available for which you cannot find a market?—That is owing to dearness of communication, I presume.

2108. The fuel is there if the local people would like to buy?—Yes.

2109. *Dr. Hyder*: Is that your experience as Commissioner of the Rawalpindi Division?

2110. *Mr. Calvert*: We have no plantations up there.

Dr. Hyder to Mr. Calvert: Is that your experience?

Sir Ganga Ram: It is stacked and sold by auction every month in Changa Manga.

2111. *Mr. Calvert*: You suggest at the end of your type-written note a reduction of the number of cattle kept by the villagers. Would you make any specific suggestion as to how that could be done?—Well, it goes to the root of the whole Indian village organisation.

2112. You are opposed to taxing them?—Do you mean to tax them so much per head? Yes, I am.

2113. Could not a good deal be done by selective breeding to prevent this indiscriminate breeding that goes on? Would you advocate selective grazing?—Let a few animals have the grazing? It might be done, but it would be very difficult.

2114. Then, might I ask if the post of Inspector General of Forests is to be retained or abolished?—I believe it is to be retained.

2115. You think it should be retained?—Yes.

2116. There are specific advantages to the agriculturists of India by retaining this post?—I hope so.

2117. You have given a list of trees to Sir Thomas Middleton chiefly for wood purposes?—For agricultural, fencing and housebuilding purposes.

2118. We also have got lac culture, but you did not mention Mulberry?—It is a very good thing.

2119. *The Raja of Parlakimedi*: Castor?—Castor, yes.

2120. *Mr. Calvert*: Sometimes grass-cutting, I believe, gives far more fodder than grazing?—Yes, because the cattle do not destroy it.

2121. Three or four times more?—Well, twice any way.

2122. So that by limiting grazing you could add enormously to the forest ground?—The villagers themselves do that in some parts; they keep large tracts of country in which no cow is allowed to go until the hay has been cut. There is not much done on the land under our control, because if we get good ground we want to grow trees, and if you get a lot of trees you do not grow much grass.

2123. Generally the forest supply could be increased by regulating and by cutting?—Yes, because the cow probably tramples as much grass as it eats.

2124. At Dehra Dun you are carrying out certain researches which will be of economic value to the agriculturist?—Yes.

2125. So that in the future we may look for greater help from the Forest Department than we have had in the past?—Certainly.

2126. You have just been given a list of questions, the list subsidiary to the Questionnaire. I should like to ask you the very first question. We have

had questions on whether you are doing your best for agriculturists, but in your opinion has this opening of forest rights been carried to an extent which is dangerous to the existence of the forests?—Only in a few areas which are practically surrounded by agriculturists and villagers. Generally speaking, the greater proportion of the forest area is sufficiently safeguarded.

2127. Dr. Hyder mentioned the Rawalpindi Division the other day. I think you have been to Murree?—Yes.

2128. Is that an area where the rights have been carried to excess?—Yes, there is no doubt about it.

2129. The opinion is that the rights have been carried to such an excess as to cause a permanent injury?—The famine of 1921 was the reason of that; that has caused thousands of broad-leaved trees to be exterminated.

2130. So that taking the question from both aspects, the interests of the future generation of agriculturists and the interests of the present generation, you think the interests of future generations have been sacrificed to the interests of the present generation?—In areas in proximity to villages.

2131. There is not much to protect forests for future generations?—No, not much in tracts of that description.

2132. There should be further restrictions?—If it were legal; you see in the Central Provinces forest report they lay great stress on the necessity of giving the villagers in every case as much, or even more than, the forest can stand.

2133. *Professor Gangulee*: That tendency is not to be found in all Provinces?—No, but you may say that the smaller the area percentage of forest in any Province, the greater the pressure.

2134. *Mr. Calvert*: Sir Ganga Ram asked you a question about helping villagers to put certain areas under trees?—Yes.

2135. I understand there is a limit to the area in which such work is economical?—Yes, small areas are most expensive.

2136. You want about 10,000 acres?—You need not have it necessarily as big as that; in the plains I should think you could work a thousand acres quite well.

2137. What is the size of the Punjab plantations?—I cannot remember.

2138. What is the limit?—In tracts of that sort I should think a thousand acres would be quite easily workable on an economical basis.

2139. Can the Forest Department establish grass reserves or grazing reserves on a business basis?—I think we might make 2 or 3 per cent on it, if you call that a business basis. It takes a great deal of conservation and looking after, and, after all, the demand is most in the famine times, in time of War, or other exceptional circumstances.

2140. You mentioned the reclamation of land at Etawah. Is that economic?—We are not going to make a big revenue out of it.

2141. It will pay the cost, will it?—It will pay the cost. When this waste land was taken over by us it had practically no grass on it. In 1921-22, 20,000 maunds of grass were cut, and in 1924-25, 50,000 maunds were obtained from the same area. That is entirely owing to afforestation, the conservation of moisture and the fixation of the soil.

2142. In fact, so far from cutting down the rights of the people, you are doing your best to increase the forest supply for them?—I think that is quite a fair thing to say.

2143. There is another similar proposition relating to lands which are unsuitable for agriculture, such as saline lands?—Yes.

2144. Is there scope there?—Certain trees can be found to grow on those lands; I have no doubt that with proper methods of trenching and draining, and getting the right trees, we can get them planted up.

2145. Speaking generally, I suppose in a Province like the Punjab it is useless in the plains attempting afforestation without irrigation?—I fancy so; it would be too expensive.

2146. It is hopeless in the Sind valley to attempt afforestation without irrigation. Now this question of grazing falls roughly into two classes, grazing by owners of neighbouring lands and grazing by pure traders?—That is right.

2147. Would you be in favour of restricting the traders?—Every time. The only thing is that if you do that, you cut the supply of *ghi* for the big towns, and they have got to get their supply of *ghi* from somewhere.

2148. In fact the traders actually injure the rights of the agriculturists?—Yes, these people who wander about do enormous damage and do no good to the district they graze in.

2149. Your department is now on a purely business basis?—We call it semi-commercialised.

2150. And therefore your kindness of heart towards the agriculturist has to be restrained by considerations of the balance sheet?—No, I do not think you will find that; most forest officers have a bias in favour of doing everything they can for the villagers, if the villagers will help them. That is a policy of the Government which has been laid down on numerous occasions, and I think the ordinary forest officer understands that perfectly.

2151. *Mr. Kamat:* Have you heard any allegations of corruption regarding your forest subordinates?—I have heard of them, yes.

2152. Are they very numerous?—Well, a fair number at times.

2153. Have you reason to believe that the harassing by subordinates has gone in certain Provinces to such an extent as to require close investigation?—No, I have never heard that.

2154. On the first page of your typed statement you say with reference to the proper utilisation on a systematic and economic basis of the forest reserves that a change that would be desirable would be to have thoroughly reliable officials in charge of the forests?—Yes.

2155. Do you suggest that the present officers are not reliable and that you require a change?—I know from personal experience that the ordinary forest guard is very careless, and unless he is supervised he does not do his work properly.

2156. I presume you are referring to the officials?—I mean the forest guards; I did not mean the gazetted officers.

2157. Then for this utilisation what you require is not new and reliable officials but an entire change of outlook on their part, a more liberal outlook; is that what you mean?—The gazetted officer should be able to see more of his forests and to help the agriculturists by seeing that they get the produce to which they are entitled without trouble. That is what I meant by saying it is necessary to have thoroughly reliable officials in charge of the forests.

2158. As this is very important from the point of view of the agriculturist, should not it be made perfectly plain to your officers throughout the Provinces that their policy should be liberal and that the widest publicity of this liberal policy should be made, so that agriculturists may know that you have adopted a liberal policy?—When the gazetted officer goes round and talks to them they understand that.

2159. Are you satisfied that sufficient publicity is given to your liberal policy?—Would you mind telling me what you mean by publicity in this connection?

2160. I have reason to believe that the villager does not know of this liberal policy of the Government. Do your officers and subordinates make it plain, either by posters or by circulars in the villages, that Government would be prepared to give the wood and fodder provided no waste is committed by the villagers?—They all know that.

2161. Sufficient publicity is given?—I think so; I do not say there is a great deal of posting up of notices, because I am not very keen on that, but I think the thing is talked about and the ordinary forest officer explains to his villagers what they can get.

2162. *Mr. Calvert*: They all know their rights?—Yes, they know their rights to the fullest extent.

2163. *Mr. Kamat*: Apparently you are prepared to give the wood and other things on a more liberal scale, but there are complaints that this is not being done. Why is not some system evolved by your officers to ensure the wood being cut properly and given to the agriculturist?—Because the ordinary forest guard is a very careless man, and he would very often rather sit in the village than go and look at his forest.

2164. Then it is the fault of the forest guard and not of the villager?—The villager takes advantage if his cutting is not supervised, he cuts as he likes.

2165. Is it the fault of the habits of the people or of the guard?—Both.

2166. With regard to village forests, do you receive complaints that the grazing allowed round about villages is not sufficient for the village cattle?—Do you mean the amount we give them out of what we have is not all we can give them, or that there are too many cattle for the grazing?

2167. I mean too many cattle for the grazing?—Well, that occurs in many places; we know that.

2168. Then by way of relief do you see that there is adequate grazing in comparison with the cattle of the village, and if it is inadequate, do you release forest area for further grazing?—No, there is not any; we give them all we can as a rule in the areas where grazing is intensive.

2169. That means that whatever the census of the cattle, the area reserved for forest grazing round villages is awarded; you do not reserve it?—We give them all we can on every occasion.

2170. You mean you revise the area available from time to time?—Yes.

2171. As a matter of general policy should agriculture or the semi-commercial interests have the prior right?—In the neighbourhood of villages the agricultural interests should have the prior right because it is essential for the well-being of the village.

2172. And this policy is being adhered to?—Yes.

2173. *The Chairman*: You agree it is important to inform forest officers of the points on which the forestry service can be of assistance to agriculture. Would it be possible, do you think, to attach certain suitable officers to the agricultural service for a short period in districts where agriculturists make use of forest facilities? I am thinking of developing the corps of lecturers who could carry out the work which you agreed might be useful, in an earlier stage of your examination?—Yes; you mean to send selected forest officers to a place like Pusa?

2174. I was thinking at the moment of attaching them to the agricultural service and allowing them to see for themselves from the agricultural side what is going on and what the requirements of field crops are?—Yes, that would be very sound.

2175. How about the planting of windbelts; is there much demand for that for the crops or stock?—I do not know.

2176. It would not come within your purview I suppose?—It would, but one sees these very large bare areas all over Upper India, and I am not aware as a rule that the wind does much damage.

2177. The planting of a windbelt in an area where there was not much forest would come to your notice, would it?—It might be done by the Deputy Commissioner if it were land under him; but he would be sure to call us in to carry out the planting for him, as a rule.

2178. But there is not much demand for that?—No, I think not.

2179. Do you know of any tree or shrub that will grow on alkali land?—I believe they grow in some parts of the North West, but I have not been there, and I am afraid I cannot give the name of it for the moment, but there is a shrub.

Mr. Calvert: Tamarisk.

2180. *Dr. Hyder:* And *Babul*?—That does not like it very much, but there is one shrub that grows fairly well, I think, on the *Usar* land.

2181. *The Chairman:* Is it within your knowledge whether the planting of *Usar* land with shrubs which will grow under the conditions, makes any contribution towards the reclamation of that land?—I cannot tell you that.

2182. I now put the same question in relation to *Kans* infested land. Have you any trees which would hold their own where the *Kans* weed grows (*Saccharum spontaneum*)?—We have a lot of trees which are quite happy growing in *Savannahs*.

2183. So that a rest of 30 or 50 years under forest might be a cheap and practical way of reclaiming *Kans* land, might it?—Yes.

Dr. Hyder: I think the proper remedy for that is deep ploughing.

2184. *The Chairman:* Yes, I am sure deep ploughing can be done, but it occurred to me that financial difficulties might arise. According to the documents which have been put before me, there are areas which apparently have been depopulated by the *Kans* weed; that is to say, they have gone completely out of cultivation. I wanted to get from the witness whether, as an alternative to the more expensive method of deep ploughing, it might be possible to reclaim by afforestation?—I am pretty sure it could be done. We have done similar work to that by proper planting.

2185. *Sir Thomas Middleton:* From the statement which I have here, I see that, if we exclude Burma, grazing is permitted on 4 square miles out of 5 in British India?—Yes.

2186. And in addition to the 4 square miles which are grazed, grass-cutting is permitted on the 5th mile?—Well, not quite everywhere.

2187. Could you give any indication of the extent of the grass-cutting in the reserved forests. In the Punjab we have heard from Mr. Calvert that about two-thirds of the reserved area is open for grass-cutting?—You say grass-cutting is permitted on the remaining 5th mile. Well, a good deal of that would never be cut, for one reason because there is no grass, and for another reason, because it is so remote that no villager would go there.

2188. So that the Punjab case is quite exceptional?—Yes, it is the worst for incidence of grass-cutting.

2189. *Sir Henry Lawrence:* Have you been consulted by the Irrigation Department with regard to the location of plantations in the irrigated colonies?—No. I could not tell you whether the Punjab Forest Department has been or not, but I can tell you in a few days.

2190. There is a statement in the irrigation paper presented that some 40 square miles have been planted in certain colonies, and that it is very difficult to dispose of the produce of that area?—Yes.

2191. Have you any information about that?—No, I have not heard that.

2192. Do you think there would be any difficulty in settling with the irrigation officers for the reservation of certain areas for forests?—I should not think there would be any difficulty.

2193. They would not want you to pay the full value of the water?—We pay in Changa Manga, I believe, now.

2194. You cannot expect to get places like Changa Manga all over the area?—No.

2195. That is one instance of a thoroughly productive paying proposition, is not it?—Yes, I suppose we should have to pay the irrigation dues, certainly in part, if not in full.

2196. That has been the difficulty in Sind?—Yes.

2197. That the Forest Department were not prepared to pay the rate which the Irrigation Department thought they were bound to charge?—Yes.

2198. That has been a very great obstacle in the plantation of forest areas on the Sind canals?—But it seems reasonable that they should charge us less if we are planting for the good of the countryside.

2199. That problem has not been discussed between your department and the Irrigation Department in recent years?—Not as far as I know.

I think it is very important, it should be taken up.

2200. *Sir Ganga Ram*: In connection with Changa Manga, you are only paying a lump sum; you are not paying on the area of land?—I am afraid I have never been there; I cannot say.

2201. Would it affect the value of the water if the land were given for grazing? You are paying a lump sum in Changa Manga?—But they have cut the water recently, have they not? They are giving much less water.

2202. Well, I think you deserve it?—Many of the trees are dying.

Because there was a tremendous waste of water there.

2203. *The Chairman*: Is it within your knowledge that about 200,000 acres in one district in the Central Provinces were reported by the Settlement Officer to have gone out of cultivation as a consequence of the spread of *Kans* weed?—I have not heard that.

2204. Assuming that were so and afforestation were advisable in that district, would you choose that land, provided it were reasonably fertile, for the purpose of afforestation?—Yes, it seems to me that a case like that is one of the principal objects of afforestation.

(The witness withdrew.)

APPENDIX I.

Forest Areas open to Grazing and Grass Cutting.

Province.	AREA IN SQUARE MILES.							
	Areas in which grass cutting and grazing are allowed.			Areas in which grass cutting is allowed but not grazing.			Areas in which neither is allowed.	
	Reserv- ed Forests.	Protect- ed Forests.	Total.	Reserv- ed Forests.	Protect- ed Forests.	Total.	Whole year.	Part year.
Assam . . .	1,907	14,739†	16,646	...	...	...	4,387	59
N.-W. F. Province .	5	...	5	38	.	38	53	1
Coorg . . .	433	...	433	...	...	...	88	419
Bihar and Orissa .	1,284	762	2,046	1,147	351	1,498	706	...
Ajmer . . .	76.40	2	76.60	41.88	...	41.88	17	121
Burma* . . .	...	...	...	...	..	...	23,419	...
Punjab . .	900	4,389	5,289	366	23	389	448	50
Central Provinces .	16,261	...	16,261	3,089†	...	3,089	3,382	16
Bombay .	10,104	1,260	11,364	938§	1	939	2,256	249
United Provinces	4,904	870||	5,774	2,186	39¶	2,225	2,194	69
Baluchistan .	69	482†	501	4	...	4	192	...
Madras . . .	16,981	...	16,981	1,830	...	1,830	2,441	1,052
Bengal . . .	877	...	877	1,836	1	1,837	6,241	...

* For all practical purposes the area and demand for grass cutting can be considered as negligible. The area of reserved forests in which grazing is allowed is 7,133 square miles as recorded in 1925-26.

† Unclassed State Forests.

‡ Excluding 20 square miles open to grazing for part of the year.

§ In addition there are 380 square miles of closed forests under sanctioned working plans in which grass cutting only may be allowed with the permission of the Divisional Forest Officers.

|| Include 26 square miles of Unclassed Forests.

¶ " 3 " " " "

APPENDIX II.

Trees suitable for planting for fuel and house building timber in the plains and lower hills of India.

1. Babul	. . . . .	Acacia Arabica.
2. Khair	. . . . .	Acacia Catechu.
3. Kokko	. . . . .	Albizzia Lebbek.
4. Dak	. . . . .	Butea Frondosa.
5. Kumbi	. . . . .	Careya Arborea.
6. Shisham	. . . . .	Dalbergia Sissoo.
7. Gumhar	. . . . .	Gmelina Arborea.
8. Jarul	. . . . .	Lagerstroemia Flos Reginae.
9. Champak	. . . . .	Michelia Champaca.
10. Jingan	. . . . .	Odina Wodier.
11. Kosum	. . . . .	Schleichera Trijuga.
12. Teak	. . . . .	Tectona Grandis.
13. Sal	. . . . .	Shorea Robusta.
14. Sain	. . . . .	Terminalia Tomentosa.
15. Ber	. . . . .	Zizyphus Jujuba.
16. Simul	. . . . .	Bombax Malabaricum.
17. Paper Mulberry	. . . . .	Broussonetia Papyrifera.
18. Jaman	. . . . .	Eugenia Jambolana.
19. Farash	. . . . .	Tamarix Articulata.
20. Nim	. . . . .	Azadirachta Indica.
21. Mulberry	. . . . .	Morus Indica.
22. Tamarind	. . . . .	Tamarindus Indica.
23. Pithecolobium	. . . . .	Pithecolobium Dulce.
24. Papar	. . . . .	Pongamia Glabra.
25. Jiban	. . . . .	Trema Orientalis.
26. Bamboos	. . . . .	Especially Bambusa Arundinacea.

Mr. H. A. SAMS, C.I.E., Deputy Director General of Posts and Telegraphs.

Memorandum on the work of the Post and Telegraph Department in rural areas.

There are, I imagine, few departments of the Government of India which do more to promote the welfare of village communities than Posts and Telegraphs. In addition to despatching and delivering letters and telegrams and maintaining communication between distant relatives, it brings to the door of the villager newspapers sent at a concession rate of 3 pies per 8 tolas, which keep him in touch with the outside world, it offers him facilities for investment in Government Securities and Cash Certificates, and encourages habits of thrift by furnishing a ready means of saving in the Post Office Savings Bank. To the agriculturist it brings parcels of seeds and in many cases acts as the vehicle for the sale of his produce by means of the V. P. system. It also brings information about new methods of agriculture and offers facilities for advertising his goods.

2. The extent of the facilities offered by the post office can be gauged by the fact that there were 20,791 post offices in India on the 31st March, 1926, of which nearly 16,000 are in the villages. The majority of the village offices are run by the villagers themselves who are not whole-time servants of the Post Office but follow their own callings, as Appendix I will show.

3. The postal needs of the less important localities not provided with post offices are met by the village postmen, who are peripatetic post offices. They accept letters and money orders for despatch and deliver them like the postmen in the towns. There were about 8,500 village postmen at the end of the year 1925-26.

4. When there is reason to believe, that the provision of greater postal facilities in a locality would result in the development of postal traffic and consequently of revenue, an additional village postman is employed as an experiment. If as the result of the experiment, which might extend to two years or even longer, it is found that the new revenue created by the employment of the village postman covers his pay, the appointment is placed on a permanent basis.

5. When again there is a probability, that if a village were provided with a post office of its own, instead of having to share the services of a village postman, there would be a growth of business, a Branch Post Office is opened in charge of an extra-departmental agent, i.e., a person who has an income apart from his allowance from the post office, e.g., the village school master, a local shop-keeper or the village headman. If as the result of the experiment, which may also extend to two years or more, it is found that the new revenue created by the opening of the post office, is sufficient to cover its cost, the office is placed on a permanent footing.

6. The money-order system in India is a great boon to the rural population. It brings money to the door of the village instead of his being required to call for it at the post office as is the practice in many western countries. The confidence of the public in this institution is illustrated by the figures of money-order transactions in 1924-25 given in Appendix II.

7. The Savings Bank system is very popular in India. In a country where banking facilities are by no means adequate, and where speculative investment is not the fashion, specially in the villages, the Postal Savings Bank meets a real want. The magnitude of its business and its popularity will be evident from the fact that out of 19,652 permanent post offices standing open at the end of the year 1924-25, 10,727 functioned as Savings Banks. Experimental or newly opened post offices, however, are not vested with Savings Bank powers until they have won the confidence of the Postal authorities and of the people. Appendix III shows the transactions of the Post Office Savings Bank during the year 1924-25. Orders have recently been issued to extend the Savings Banks system to the fullest extent possible.

8. As a subsidiary to its Savings Bank business, the post office purchases and sells Government Securities for its depositors. The most popular form of securities is the Cash Certificate which is greatly appreciated by the small investors—who form the majority of the clientele of the Post Office Savings Bank. This form of investment was first introduced in India in 1917-18 and at once found favour with the Indian public. The extent to which the Cash Certificate habit has grown will be seen from Appendix IV.

9. The post offices in the villages perform many non-postal duties for the public, *e.g.*, the sale of quinine, the receipt of salt revenue, payment of pensions to Indian military pensioners.

10. During the year 1924-25, 13,707 lbs. of quinine were sold through the postal agency at a total price of over 4 lakhs of rupees. The quinine sold at the post office is in the form of tabloids and provides a ready antidote for malaria in the villages where medical aid is not easily procurable.

11. In the Central Provinces and in the United Provinces, a large number of post offices act as the agents for the receipt of salt revenue and thereby enable the villagers to get a supply of salt from the Government depôts in those Provinces. During the year 1924-25, there were 300 transactions involving the sale of 131,235 maunds of salt of the value of Rs. 1,82,031.

12. In the Punjab and North-West Frontier Provinces 1,31,801 pensioners of the Indian Army receive their pensions aggregating to Rs. 1,62,48,593 through the agency of the post office. In Baluchistan, 531 military pensioners receive their pension aggregating to Rs. 71,209.

13. To meet the growing needs of the Indian villages the Director-General has ordered Heads of Circles to prepare a five years' programme for the extension of postal facilities which had received a set back for a time on account of the vigorous retrenchment in public expenditure during the last few years. In order to treat the subject methodically, the local Postal Officers have been directed freely to consult the District Officers and to depart from a rigid observance of departmental rules where a genuine need for extension of postal facilities is recognised. Particular stress has been laid on the extension of the agency of the village postmen in their capacity of peripatetic post offices to encourage the postal habit in the outlying areas.

14. The telegraph needs of villages are met by the combined post and telegraph offices which transact postal business as well as receive and despatch telegrams. The number of such offices is about 3,000. In addition, there are 3,618 branch offices all situated in villages, which receive telegrams and forward them to a combined post and telegraph or purely telegraph office for onward transmission.

15. It has, however, been felt that there is yet further scope for increasing telegraph facilities, and it has recently been proposed that all post offices should receive telegrams for despatch and effect their delivery, and that all village postmen, who go out into the remote parts of the country and cater to the postal needs of the villagers, should receive telegrams from them for despatch and if necessary help them to write their telegrams.

16. Outside the principal cities broad-casting has not attained any degree of popularity in India. Facilities exist for issue of licenses through the post office for receiving broad-cast messages. A broad-casting Company has already been formed and a license has been drafted. It is impossible to foresee what will be the future of broad-casting in India. But the Broad-casting Company will be wise if they cater for the villager to whom it may prove an important educational factor not only to the man, but what is equally important, for the women and children of the villages.

17. The real need of the country, at present, is the extension of education especially among women. The post office works hand in hand with educational institutions as will be seen from the calling of the majority of the extra-departmental postmasters given in Appendix I. A post office is demanded wherever there is a literate population and wherever there is a village school. The existence of postal facilities also stimulates the desire for literacy. From

the statistics available to the department and given in Appendix V it appears that much lee-way remains to be made up. When primary education is more general amongst the rural population, the Post and Telegraph Department will prove a very potent help.

18. A very noticeable feature of Appendix V is the high degree of literacy prevalent in Burma. This is due to their wonderful indigenous system of primary education. In every village or group of villages the *hpoongyi* or monk is the schoolmaster. He lives on the beneficence of the villagers and in return he teaches all the boys and girls of a school-going age. The result is that Burma has a greater proportion of literate population than any other province of India. In Bengal and other parts of India, the ancient system of *Gurus* and *tols* worked on the same lines, but to-day they are partically non-existent. If the villagers insisted on their Hindu priests or Mahommedan Moulvis being their schoolmasters as well as their religious teachers, the literacy of the country would be greatly augmented and therewith the postal and telegraph facilities and their attendant benefits would be considerably extended.

19. When the social reformers of the country realise this fact, when even 150 million instead of only 22 million out of 310 million people of the Indian Empire become literate, the power of the department for good and for the uplift of the people will be incalculable.

APPENDIX II.

Money-order business in the last ten years.

Year.	Inland Orders (Issued).			Foreign Orders (Issued and Paid).			Grand Total.		
	Number.	Amount. Rs.	Percentage of increase (+) or decrease (-) in number.	Number.	Amount. Rs.	Percentage of increase (+) or decrease (-) in number.	Number.	Amount. Rs.	Percentage of increase (+) or decrease (-) in number.
1915-16	31,231,231	53,92,17,506	+ 6.70	1,041,363	4,74,18,701	+11.39	32,322,594	58,66,36,207	+ 6.64
1916-17	32,331,652	57,54,48,259	+ 3.86	1,117,513	5,55,24,582	+ 7.31	33,449,165	63,09,72,791	+ 3.4
1917-18	33,903,625	62,77,87,899	+ 4.86	1,285,727	12,92,78,378	+ 15.05	35,189,352	75,70,66,277	+ 5.20
1918-19	34,881,624	69,03,62,433	+ 2.88	1,225,316	9,74,20,140	- 4.69	36,106,940	79,67,82,573	+ 2.60
1919-20	37,632,888	74,71,43,409	+ 7.89	1,357,927	12,73,87,907	+ 10.82	38,990,815	87,45,11,316	+ 7.99
1920-21	37,226,484	85,73,96,210	- 1.80	1,278,330	12,62,52,106	- 5.86	38,504,814	98,36,43,316	- 1.25
1921-22	38,328,207	78,41,66,052	- 10.47	1,038,048	6,56,14,734	- 18.79	39,366,255	84,97,80,786	- 10.75
1922-23	31,742,713	78,29,80,898	- 4.75	1,011,438	5,21,86,435	- 2.56	32,754,201	83,51,17,333	- 4.89
1923-24	32,579,252	80,06,60,606	+ 2.64	1,050,778	4,86,08,266	+ 3.88	33,630,030	84,92,68,902	+ 2.67
1924-25	33,854,367	82,75,60,989	+ 3.85	1,142,962	4,96,72,475	+ 8.77	34,977,329	87,72,33,464	+ 4.01

Names of Circles.	Number of head banks.	Number of sub-banks.	BALANCE OF ACCOUNTS.				Opening balance.		Deposits.	
			Balance of the preceding year.	Opened during the year.	Closed during the year.	Balance.				
							Rs.	A. P.	Rs.	A. P.
Bengal and Assam.	39	2,595	613,754	76,388	38,407	651,735	6,50,57,066	2 8	5,20,73,372	9 7
Bihar and Orissa.	21	864	140,687	21,796	12,200	152,283	1,61,38,940	13 10	1,25,33,635	15 3
Bombay	25	1,446	364,138	47,313	59,290	3,511	4,81,00,812	12 64	2,70,91,224	11 8
Burma	23	392	79,863	16,990	15,033	81,820	79,97,702	15 3	76,46,071	6 0
Central	21	860	103,228	18,071	30,246	91,053	1,27,68,110	14 3	1,02,25,297	10 0
Madras	37	1,788	250,248	50,913	24,999	276,162	1,52,91,650	0 11	1,90,58,944	0 5
Punjab and North-West Frontier.	33	830	240,279	66,410	53,783	252,906	3,89,53,243	15 10	3,92,20,356	11 2
United Provinces.	47	1,419	246,848	55,852	43,630	259,070	3,57,97,869	9 5	3,03,72,724	14 3
Sind and Baluchistan.	4	228	50,269	10,745	11,731	49,283	68,78,272	13 11	64,15,385	13 9
Total for 1924-25.	255	10,472	2,089,314	364,478	289,319	2,164,473	24,78,83,170	2 74	20,55,37,103	12 1

DIX III.

Office Savings Bank.

Interest.		Total.		Withdrawals.		Balance.		Average number of deposi- tors per bank.	Average balance in each bank.	Average balance at credit of each depositor.
Rs.	A. P.	Rs.	A. P.	Rs.	A. P.	Rs.	A. P.		Rs.	Rs.
19,10,358	8 10	12,08,40,797	5 1	5,07,28,524	5 10	7,01,26,272	15 3	247-43	26,623-48	107-59
4,65,166	7 6	2,91,37,743	4 7	1,20,61,103	4 2	1,70,76,640	0 5	169-81	19,295-63	113-62
13,67,350	7 5	7,65,59,387	15 7½	2,96,75,474	6 3½	4,68,83,913	9 4	239-40	31,872-13	133-13
2,21,170	6 0	1,58,64,944	11 3	76,17,414	9 1	82,47,530	2 2	197-15	19,873-56	100-80
3,59,303	7 2	2,33,52,711	15 5	1,03,58,538	5 8	1,29,94,173	9 9	103-35	14,749-34	142-70
4,21,146	14 10	3,47,72,056	0 2	1,92,64,515	4 11	1,55,07,540	11 3	151-32	8,497-28	56-15
11,29,330	10 2	7,93,02,931	5 2	3,81,55,394	10 9	4,11,47,536	10 5	275-49	44,823-02	162-60
10,43,528	12 2	6,72,13,623	3 10	2,97,71,694	14 5	3,74,41,928	5 5	176-71	25,540-19	144-52
1,94,016	0 2	1,34,87,674	11 10	65,18,303	9 0	69,69,371	2 10	212-42	30,040-39	141-41
71,20,636	10 3	46,05,40,870	8 11½	20,41,45,963	6 1½	25,63,94,907	2 10	201-77	23,901-82	118-45

Statement of Post Office 5-years Cash

Names of Circles.	Issued.						Cost price realised.
	Denominations.						
	10	20	50	100	500	1000	
							Rs. A. P.
Bengal and Assam .	7,898	5,647	8,290	28,906	9,747	8,658	1,23,17,18 12 0
Bihar and Orissa .	942	899	1,149	4,086	1,836	1,717	28,46,337 8 0
Bombay .	7,656	6,880	9,121	36,119	13,473	11,131	1,66,12,207 8 0
Burma	289	490	406	1,499	923	773	10,63,042 8 0
Central	2,538	1,894	2,490	7,737	3,640	2,397	38,88,845 0 0
Madras	2,029	2,024	1,991	5,812	2,249	2,192	30,48,515 0 0
Punjab and North-West Frontier.	2,539	2,643	3,774	13,278	7,507	5,328	83,88,402 5 0
United Provinces .	4,203	4,339	5,386	17,707	8,305	8,243	1,09,25,280 0 0
Sind and Baluchistan .	1,619	1,187	1,631	5,772	1,796	1,629	124,10,260 0 0
TOTAL .	29,708	26,003	32,238	1,15,916	49,476	42,568	6,09,94,453 9 0

DIX IV.

Certificates issued and discharged.

Discharged.								
Denominations.						Amount paid.		
10	20	50	100	500	1000	Principal.	Interest.	Total.
						Rs. A. P.	Rs. A. P.	Rs. A. P.
17,767	3,122	2,744	9,830	4,231	870	33,07,126 8 0	4,27,495 2 9	37,34,621 10 9
3,507	705	645	1,723	855	140	6,25,599 12 0	95,720 11 9	7,18,320 7 9
3,572	3,084	3,019	9,452	4,124	327	31,38,727 8 0	3,68,790 6 0	5,07,517 14 0
1,363	879	469	1,374	655	132	4,99,518 12 0	65,531 6 9	5,65,050 2 9
3,611	1,449	304	1,436	1,226	163	8,53,572 12 0	95,750 9 9	9,49,323 5 9
3,353	1,042	1,009	2,348	921	264	8,06,682 12 0	85,687 13 6	8,92,370 9 6
4,685	2,173	1,745	5,328	2,776	530	19,91,186 4 0	2,10,330 7 3	22,01,566 11 3
6,198	2,096	1,780	5,701	2,302	746	22,03,674 12 0	2,09,560 12 0	24,13,235 8 0
1,799	484	430	1,797	866	125	5,98,076 8 0	74,422 0 3	6,72,498 8 3
51,350	15,034	12,645	39,989	8,456	3,797	1,40,24,165 8 0	16,30,339 6 0	1,56,54,504 14 0

APPENDIX V.

Number of post offices and letter boxes in relation to area and population and number of postal articles (excluding money-orders) in relation to population.

Names of Circles.	Area in square miles.	CENSUS OF 1921.		ONE POST OFFICE SERVES			ONE LETTER-BOX SERVES			Total number of postal articles (excluding money-orders).	NUMBER OF POSTAL ARTICLES PER HEAD OF	
		Population.	Literate population.	Square miles.	Popu- lation.	Literate popu- lation.	Square miles.	Popu- lation.	Literate popu- lation.		Popu- lation.	Literate popu- lation.
Rengal and Assam	148,381	55,582,708	4,817,437	40	14,894	1,291	10	3,758	326	263,325,763	4.75	54.76
Bombay . .	140,568	23,421,771	2,047,334	50	8,374	732	11	1,868	162	232,042,496	9.91	113.34
Madras . .	182,111	66,111,019	5,595,266	50	18,053	1,528	15	5,584	473	210,449,457	3.18	37.61
United Provinces	161,886	47,765,832	1,735,016	69	20,421	742	18	5,274	192	132,380,084	2.77	76.30
Punjab and North-West Frontier.	234,340	31,204,029	1,191,079	74	9,322	375	28	3,694	141	172,068,988	5.53	144.97
Bihar and Orissa	111,829	37,961,858	1,701,489	85	28,737	1,288	24	8,294	372	67,963,288	1.79	39.94
Burma . .	236,738	13,212,192	3,652,043	504	23,111	7,770	71	3,942	1,090	55,238,831	4.18	15.13
Central . .	282,614	31,063,263	1,218,549	159	17,432	684	75	8,207	322	75,309,899	2.43	61.86
Sind and Baluchistan.	187,194	4,272,133	222,081	503	11,484	597	211	4,822	251	32,847,000	7.89	147.91
TOTAL .	1,685,661	310,594,805	22,180,294	86	15,805	1,129	24	4,462	319	1,242,796,706	4.00	59.03

Replies to the Questionnaire.

[It will be understood that the opinions expressed are my own personal opinions and do not necessarily represent the opinions of the department.]

QUESTION 4.—ADMINISTRATION.—(c) (v) *Post Office*.—As I have stated in my reply to Question 23 (iii) on elementary school education, the activities of the post office can only follow the advance of education.

I propose to show what facilities the post office gives to the population of India generally and in some instances in rural tracts in particular.

The figures below show the figures for the 31st March, 1925 compared with those for the 31st March, 1904.

	31st March 1904.	31st March 1925.
Post Offices	15,403	19,652
Letter Boxes	34,005	49,959
Village Postmen, i.e., peripatetic post offices .	8,242	8,468
Runners and boatmen	92,137	87,089
Miles of lines served by—		
(a) Railways	26,517	36,570
(b) Steamers	18,289	18,485
(c) Mail carts, etc.	8,712	8,763
(d) Motor cars	Nil	5,211

Out of the total of 19,652 post offices approximately 18,000 serve rural areas. All the 8,463 village postmen serve rural areas.

It will be observed that the total increase of post offices during the last 20 years has been considerable. During the second decade which includes the Great War and the activities of the Retrenchment Committee, the increase is small; but in 1924-25 the number of post offices has increased by 162 and by August of this year there has been a further increase by 1,239 including experimental offices making the total number 20,891.

The department is fully alive to the necessity for extending postal facilities in rural areas and during the last year and the current year has been devoting special attention to this subject.

The post office watches the demand for postal facilities in the following way.

The Postal Inspector, the officer in charge of a postal sub-division, receives in June and December of each year direct from each head, sub and branch office in his sub-division a return, called the "Half-yearly Village Return," kept for the first fourteen days in those months, showing the number of articles of all sorts within the jurisdiction of the office. The Inspector examines these returns and forwards them to the Superintendent with any remarks he may have to make. From these half-yearly village returns the Superintendent decides whether an increase is required in the number of letter boxes, of village postmen or of offices.

If it is decided that another village postman (i.e., a peripatetic post office) or even a new office is required, he takes steps to get sanction to an experimental establishment. The experiment is carefully watched and, if the village postman or office is justified according to the standards of the Department, the experimental establishment is made permanent. These experimental establishments include also the conveyances of mails usually by runners' lines.

The process of postal evolution in rural areas usually follows the following lines—

- (a) a letter box in the village,
- (b) a village postman serving the village,

- (c) a branch office with restricted powers served by an extra-departmental agent, *e.g.*, a schoolmaster, *patwari*, *lumbardar*, shop-keeper, on an allowance,
- (d) a branch office with greater powers served by a departmental or whole-time branch postmaster,
- (e) a sub-office with full powers.

One of the postal facilities most helpful to the agriculturist is the savings bank. Appendix I gives some statistics for the last twenty years. It will be observed that there has on the whole been a steady increase in the number of savings banks. Out of 20,891 post offices open up to August, 1926, 9,528 do no savings bank work. These comprise branch officers, departmental and extra-departmental, where the standard of education of the branch postmaster is not sufficiently advanced to entrust him with savings bank work. We hope gradually to extend savings bank powers to as many offices as possible.

Another facility which must play an important part in rural life in India is the money-order system which enables a villager to be paid a money-order by the village postman at his own door. In 1905-06 the number of money-orders was 19½ million valued at over 33 crores. In 1924-25 the number was nearly 34 million valued at nearly 83 crores. Out of a total of 20,891 post offices open up to August 1926 only 438 have no money-order functions and these are offices which have recently been made permanent or are not yet permanent and have to prove that their stability deserves the grant of money-order powers, which of course involve no little monetary responsibility.

The money-order business includes the V. P. business which means a great deal to the tradesman in the cities. The villager can take the same advantage of the v. p. p. system. He can despatch his produce from the nearest railway station and receive payment at his door.

(c) (vi) *Telegraphs including Wireless*.—1. The rural population is chiefly concerned with combined offices, *i.e.*, offices which do both post and telegraph work. In 1904-05 there were 1,917 combined offices: in August, 1926, there were 3,654.

Out of a total of 20,891 post offices 3,654 are combined. Out of these 3,484 are sub-offices, most of them in small towns and in the larger villages.

Besides these, combined offices are 4,841 post offices which have no signalling staff but receive and forward to the nearest telegraph office messages received from the public. An effort is being made widely to extend this system to the still smaller post offices and even to village postmen.

A wide extension of telegraph facilities without expectation of an adequate return is, I fear, out of the question on financial grounds. The cheapest average estimate for a mile of posts and a single wire is Rs. 300. A long lead to a remote village would obviously result in a very great capital expenditure which would require a considerable amount of traffic to meet the interest alone. As with the post office, the spread of education will inevitably lead to the extension of the telegraph system. But in a country, where there are only four postal articles per head of the population, it may well be imagined that the genuine demand for telegraph facilities in rural areas cannot be great. According to the figures for 1924-25 the average number of telegrams per head of the population is .04. It is hoped, however, that the measures now being taken to extend the Receiving Office system will bring the telegraph system to the village without any considerable extra expense.

With respect to Wireless I attach a note (Appendix II) by Mr. Edmunds, the Director of Wireless, on Broadcasting and its bearing on agriculture in India.

QUESTION 23.—GENERAL EDUCATION (i) *Higher or collegiate*.—I make the following remarks with great diffidence, as I am not conversant with the recent development of higher or collegiate education.

Considering that the boys who attend such colleges as the Mayo College, the Daly College, the Raj Kumar College at Raipur, and the Chiefs' College at Rajkot, are the sons of landowners on a large scale, I venture to think that an important part of the college curriculum should be in subjects dealing with the management and improvement of the land, knowledge of fertilisers, irrigation by canal or mechanical means, the marketing of produce, stock breeding, etc.

The interest taken in these subjects by the big landowners, including His Majesty the King, in the United Kingdom, has, I think, played a very considerable part in the agricultural development of that country.

It seems to me that if we could induce the sons of Ruling Princes and Noblemen of India to take a practical interest in agriculture, we should go some way to helping its development in India. Such an interest is obviously best acquired during the impressionable period of boyhood and early manhood.

(vi) *Elementary School Education.*—One of the outstanding features of India is the amazing lack of literacy of the population. As I have stated in the Memorandum which I have submitted to the Royal Commission, out of a population of 310½ million according to the census of 1921, only 22 million are literate. The average number of postal articles per head of the population is 4 only. This state of things may be due to a defect in the educational system but it is more probably due to the social system. It is regrettable for the sake of India that its indigenous education has not followed that of many countries where in the initial stages it was in the hands of the religious teachers. Most of the great public schools in England were founded by leaders of religion or by rich merchants who came under that influence. In India so far as I am aware, the recognised leaders of the two great religions, *viz.*, the Mohants and Moulvies, have done little or nothing to educate the people. Most if not all of the education in this country has been the result of Government activities or the work of Christian missionaries.

In striking contrast to this, as I have noted in my Memorandum, is the indigenous system of primary education in Burma. At the risk of repetition I recapitulate that system. In Burma the *hpoongyi*, or Buddhist priests, enjoy the hospitality of the villagers in the shape of a monastery (*hpoongyi kyauung*) and free doles of food. The Burman considers that he acquires merit by housing and feeding the *hpoongyi*. In return the *hpoongyi* teach every boy and girl of the village the three "Rs". The result is that in Burma out of a population of 13½ million, including children and a very large alien population, 3½ million or roughly 25 per cent. are literate, whereas in Bengal with a population of 55½ million, only 4½ million—about 7 per cent—are literate. In Madras where perhaps education is more advanced but where the caste system is stricter than elsewhere in India, the percentage is about 7 per cent. In the United Provinces it is a little more than 2 per cent. In Burma not only is there a high percentage of literacy, but what is more important for a community, the girls and future mothers are literate.

Until the Hindu priest and the Mahommedan Moulvi teach the young villagers in the same way as the *hpoongyi* does in Burma, the prospect of largely increasing the literacy of India will have to depend on Government and for financial reasons will be far distant.

I venture to make a suggestion for what it is worth. A Brahmin priest or a Moulvi who as part of his religious duties has an organised school for the education of the village boys and if possible the girls, should receive a definite honorific title to be bestowed by Local Governments answering somewhat to the Scotch 'dominie', and a *Sanad*. Such a practical step would, I think, give a direct stimulus to indigenous primary education, and would give it an honourable place in the social life of India.

Until education is much more widely spread than it is at present any effort to improve agriculture among the rural population will be handicapped by a lack of means of communicating with the people.

As soon as the people as a whole are literate, the Post Office will play a very important part in the life of India. In fact, it is not perhaps too much to say that it will be the biggest organisation of its kind in the world. The post office meets the demand for postal facilities but it cannot stimulate it to any great extent. It is obviously useless to provide postal facilities where only two people out of 310 are able to read and write. The Post Office tries to keep pace with but cannot for financial reasons be in advance of the demand.

APPENDIX I.

Savings Bank Business.

Year.	Number of savings banks,	Average of depositors per bank.	Average balance at credit of each depositor.
1904-05	7,855	134.79	126.62
1905-06	8,071	135.89	130.83
1906-07	8,049	147.87	133.99
1907-08	8,328	151.62	120.22
1908-09	8,501	155.11	115.53
1909-10	8,767	157.28	115.07
1910-11	8,929	160.20	118.28
1911-12	9,502	157.95	125.32
1912-13	9,460	165.63	131.55
1913-14	9,824	166.81	141.38
1914-15	10,161	161.80	90.58
1915-16	10,386	159.87	92.27
1916-17	10,421	158.08	100.73
1917-18	10,975	149.21	101.27
1918-19	10,587	158.44	112.22
1919-20	10,670	164.98	121.26
1920-21	10,713	175.29	121.73
1921-22	10,758	182.03	113.68
1922-23	10,730	190.44	113.52
1923-24	10,535	198.32	118.64
1924-25	10,727	201.77	118.45

APPENDIX II.

Note on use of Wireless Broadcasting for Agricultural Education by Mr. P. J. Edmunds.

The present position regarding broadcasting in India is that an agreement was signed between the Indian Broadcasting Company, Limited, and the Secretary of State on 13th September 1926, under which the Company undertakes to erect broadcasting stations at Calcutta and Bombay within 9 months of the date of that agreement; the Company is granted a virtual monopoly for ten years in broadcasting in British India excluding Burma and will be granted 80 per cent. of the fees realised by Government on the issue of Broadcast Receiver licenses at Rs. 10 per annum per receiving set. It is not known whether the Company propose to broadcast matter dealing with agriculture; they are a commercial company and will presumably model their programmes according to public demand in order to obtain the maximum number of licenses. There is however a provision in the agreement under which Local Governments have the right to transmit from these stations, free of charge, providing the time occupied does not exceed 10 per cent. of the total period occupied by the programme of which the Government matter forms a part. Agricultural information is specifically mentioned in this connection, and there is no reason why the Local Governments should not take advantage of this provision for the purpose of agricultural education. No arrangements for commercial broadcasting have yet been made in Burma or in the Indian States; as regards the former, Government is prepared to enter into an agreement similar to the present agreement with the Indian Broadcasting Company should application from a suitable person be received; regarding the latter it has been decided that Indian States should be permitted to erect broadcasting stations subject to some general conditions which have been laid down. At the present moment small broadcasting stations are being worked in the towns of Bombay, Calcutta, Madras, Rangoon by Local Radio Clubs but their range is insufficient to reach agricultural districts.

2. As regards prospects in the immediate future (i.e., when the Company stations at Bombay and Calcutta are working), I am personally of the opinion that the agricultural population will not be reached by wireless to any extent unless a special effort is made to encourage it. The proposed stations will not be received from greater distances than 200 miles unless a fairly elaborate form of receiver is employed. The great part of the agricultural population is probably not sufficiently rich to purchase such a set and there is further the language difficulty. I believe, however, that if Government were prepared to organise a system of hiring out wireless receivers on a maintenance basis and to undertake suitable propaganda work to make the arrangement well known in the districts, a large number of sets would be hired by village communities for common use and the organisation would eventually become self-supporting. Careful organisation and propaganda are however essential. It would probably not be worth while to make such an organisation for agricultural purposes, but it would be of immense value for all kinds of Government educational work and propaganda, and should be considered from all points of view simultaneously.

3. As regards the future I personally am convinced that broadcasting is going to become a very important factor in India, and I do not think it is at all unreasonable to anticipate that the number of Broadcast Receiver licenses will be measured by millions within the next 20 years. It may be within the next 5 years, but the rate of progress depends so very much on how the problem is tackled that it is difficult to estimate. Eventually I have no doubt that there will be at least a dozen broadcasting stations in India; every village of 10 or 20 families will have its own receiver with loud speaker and broadcasting would then offer a very powerful instrument for the spread of all kinds of education including that relating to agriculture.

Oral Evidence.

2205. *The Chairman* : Mr. Sams, you have been good enough to put in a note of what you wish to lay before the Commission. The Commission has also before it a memorandum on the work of the Posts and Telegraphs Department in rural areas, prepared by yourself and circulated some time ago?—Yes, it was however prepared by my assistant under my direction.

2206. I think the two documents together give the Commission some very interesting information, and I am greatly obliged to you for the trouble you have taken in preparing them. You emphasise, I notice, the relationship between the spread of literacy, of education and the demand for the services of your department?—Yes.

2207. You think, at the same time, that your department is capable of and does in fact stimulate the desire for literacy and also does something to sustain literacy once attained?—Well, I think it does. If there is a post office in a place, or if there are postal facilities, I think it is an encouragement. At the same time, as I have said in my replies to the Questionnaire on the question of education *vis-a-vis* the post office, we cannot be in advance of the demand; we must be slightly behind it. We cannot afford to have a post office or even a pillar box where one is obviously not wanted.

2208. Do you put up bulletins in the shape of news on your post offices at all?—No, we do not.

2209. Do you think it would be possible; would short bulletins be expensive?—Bulletins prepared by the department?

2210. Possibly, or by some other department?—We can always put them up in the post office; it would be quite easy to do that. In fact, we actually do use the post office for putting up Government notices in case of loans or in the case of epidemics.

2211. Of course, tastes in these matters differ, but I do not think information about epidemics or Government loans are very pleasant reading; I was thinking of something in the shape of a short news bulletin to encourage reading in villages where newspapers never appear?—It would be quite feasible for us to put them up in the post office; it would not, I think, be for us to prepare these bulletins.

2212. If they were transmitted during the quiet hours of the day, do you think the expense of transmission would be an important consideration?—Do you mean by telegraph?

2213. You would either have to post or telegraph them, would you not?—Yes.

2214. I am asking you whether you think the expense would be important, provided they were, let us say, telegraphed during the quiet hours of the day?—Yes, it would be a very considerable amount, I imagine, if it were done by telegraph.

2215. It might be done by post?—Yes, it could be done by post, at the expense of the Publicity Department.

2216. I was wondering whether you were going to say that or not. You do not think it might be a good investment from the post office point of view. You point out the close connection between literacy and the requirements of your services; you do not think the putting up in rural villages of short but interesting bulletins might stimulate the demand for literacy?—It certainly would I think, but it is very difficult to say how far it would bring us in much as a department.

2217. It does not attract you on the financial side?—I do not think there would be much in it.

2218. What interest do you pay on your savings bank certificates?—3 per cent.

2219. Do you make money on it at that rate of interest?—We only act for the Finance Department; they pay us for our services as managers of the bank.

2220. Is it within your knowledge whether the Financial Department makes money at that rate of interest?—No, I cannot say.

2221. But I suppose you would welcome an important addition to the amount that passes into the savings bank, would you not?—Yes, certainly.

2222. Would it be possible to give any direct encouragement to individuals bringing in new subscribers?—To the savings bank?

2223. To the savings bank?—I do not think so, because the idea of the savings bank is laid down as the helping of people to save and the encouragement of thrift. It is not looked on as a money-making concern.

2224. I am anxious if possible to stimulate the practice of saving. Without knowing the conditions in Indian villages, it occurs to me that having regard to the fact that a large portion of the population is illiterate you are quite unable, by advertisement or other means, to bring to the notice of a large part of the cultivators the advantages and attractions of saving. I am asking you whether you do not think you could get, at very small expense, an active body of agents, if you gave some small monetary reward to persons bringing in new subscribers?—Yes, undoubtedly; we certainly would, if we were prepared to give a reward.

2225. The idea does not attract you?—I do not think we as a department are prepared to do so. We provide the facilities and it is for the people to take advantage of them.

2226. Do you think a knowledge of the advantages of saving is likely to reach an illiterate population without any effort on your part?—I think so, if there is a savings bank in the nearest town or village and they know one or two people who send their savings to it. I fancy that that would encourage others to do the same.

2227. I should have thought the savings movement in villages was one which was worth all the encouragement which could be given to it. I have one question about wireless telegraphy. I understand that India is soon to have broadcast stations?—Yes, Mr. Edmunds, the Director of Wireless, has mentioned that in his note. The agreement between the Secretary of State and the Company was signed last month.

2228. Do you think wireless telegraphy may develop into something very important in India in the next 10 or 15 years?—Yes, I certainly think it will. Its possibilities are simply enormous.

2229. There is the possibility of education?—Yes.

2230. And of increasing the amenities of rural life in remote villages?—Yes; if the transmitting station can reach the remote villages and they can afford to have a receiver or if some organisation can provide a receiver, I think it will make a tremendous difference to their lives, as it has in England.

2231. I agree?—It will require a great deal of organisation. At present, I imagine, this company only intends to provide a certain amount of entertainment. If it comes to education the matter will have to be very carefully considered, but I too think that the possibilities are enormous.

2232. How about the difficulty of the multiplicity of vernaculars? Is that a very formidable one?—I do not think so, if there are enough transmitting stations. If there were a station at Lahore, for instance, Punjabi would be generally understood within its radius. I do not know exactly how the transmitting organisation would do it, but they would presumably devote certain times to vernacular and others to English transmission. I do not think that the vernacular difficulty comes in very much.

2233. You agree that there are immense possibilities before, broadcasting?—Immense.

2234. If I may take you back to the subject of savings banks for a moment, I would like to take you one stage further. If you as a service are not prepared to develop a system of canvassers, do you think something in the nature of co-operative organisations for the encouragement of investment might meet the point? Do you know that they exist in India?—I do not know of them specially.

2235. The co-operative people are not investing in savings banks?

Mr. Calvert: We are in opposition to them.

2236. *The Chairman:* I was only at the moment concerned to see whether the service was inclined to advertise in the press their own savings system?—We have not considered the question at all. It is rather difficult to say. We try to supply a service for which we are asked; we have not so far gone in very much for propaganda work. We manage the savings bank on behalf of the Government of India generally, and particularly of the Finance Department. Similarly with cash certificates; we sell them for the benefit of the Government of India generally and on behalf of the Finance Department.

2237. *Mr. Kamat:* You have given us some comparative figures of the number of post offices during the last 20 years?—Yes.

2238. I see during the last 20 years about 4,000 new post offices have been opened. Is that correct?—Whatever is put down in the answer to the Questionnaire is correct; it is taken from published reports.

2239. Instead of 15,000 in 1904 there are now 19,652, an increase of about 4,000 in 20 years?—Yes.

2240. Is that a very satisfactory increase, in your view?—I think it is very satisfactory. During the last decade we have had the War and retrenchment, which has somewhat cramped our style; but since then, we have been making very rapid strides indeed, and we propose to go on making those strides.

2241. I believe Government raised the postal rates recently?—Yes.

2242. In 1922, I think?—Yes.

2243. When the postal rates were enhanced, there was a sort of assurance given that the increase in the revenue would go towards an increase of facilities in the way of the opening of new post offices in villages and rural areas?—Yes.

2244. Has that been carried out?—Yes, it is being carried out.

2245. I should like to know how much of that increase in revenue has gone towards the improvement of the pay and prospects of postal employees and how much towards the opening of new post offices?—I cannot say that.

2246. Are you satisfied that a fair share goes towards the opening of new post offices?—Certainly. The figures I have given you will show what that increase has been.

2247. I do not see the percentage?—I have not given that, but you can see how many post offices have been opened. In paragraph 3 there is a comparison between 1904 and 1925, and later on I have shown that on the 31st March 1925 there were 19,652. There has been a further increase up to the 1st August last to 20,891, which is rather a marked increase.

2248. Have you got a definite programme that during the next 5 or 10 years you will open so many new post offices?—Not at present. We have asked the Postmaster General to submit such a programme and it is in course of submission now, but we have not received it yet.

2249. Since 1922 you have not been working to a definite programme in the matter of opening new post offices?—No. It has been done as funds have been available. It has depended chiefly on the provision of funds.

2250. Would it not be a good system to work to a definite programme, that during the next 5 or 10 years so many new post offices should be opened?—Certainly. Instructions have been given to the Postmaster General to that effect. We have asked them to submit their programme.

2251. Can you give us any rough idea of how many new post offices you think it may be possible to open in villages during the next 5 years?—I should think at a rough estimate we ought to open something like 500 a year.

2252. You would regard 500 a year as the normal rate of increase?—Yes. I think that would be quite a fair estimate. It depends, of course, on whether there is actually a demand for them. We cannot open them simply

for the sake of doing so; we must feel there is likely to be some kind of demand for them.

2253. Have you any idea how many villages there are in the whole of India?—I have no idea.

2254. I should say something like 700,000?—Would you?

2255. If the rate of opening new post offices is about 500 a year, it will be a very long process indeed to instal a post office in every village?—It is almost impossible, and probably unnecessary.

2256. *Sir Ganga Ram*: There are 685,000 villages.

The Witness: Do you aim at having a post office in every single village?

2257. *Mr. Kamat*: No, because some of them are very small. My point is that 500 a year is not a fair rate of increase?—I think it would be a very fair rate of increase, considering the illiteracy of India.

2258. You have given us an interesting note about the spreading of literacy in villages?—I have done so with great diffidence.

2259. Through the instrumentality of priests and Moulvis?—Yes.

2260. That is based on the analogy of Burma?—Yes.

2261. May I know whether these priests in Burma derive sufficient emoluments from the charity of the people to have a decent living in the villages?—As far as I know (*Sir James MacKenna* could tell you better) they have no emoluments whatever. The Buddhist *hpyoongyi* is not allowed to touch money; it is against his religion to look at women or to touch money. He gets his residence at the *hpyoongyi kyaung* and goes round every day with a large black bowl, into which the villagers throw whatever they can spare in the way of rice, bananas and vegetables. It is a common sight every day in a Burmese village. They are literally boarded and lodged by the villagers.

2262. The same sort of system prevailed in ancient India; the priests, the Brahmins, went round with a bowl and derived enough for their living from the village people?—I was only dealing with modern India.

2263. If in modern India the Hindu priests in the villages could not make a decent living out of charity, do you think Government should support them or supplement their earnings by giving a sort of honorarium?—Certainly not.

2264. You would therefore be content simply to give the priest a title, with no supplementary or subsistence allowance?—I always assumed the priest or the Moulvi was able to subsist; I did not suspect otherwise.

Professor Gangulee: Quite. He is quite well-fed.

2265. *Mr. Kamat*: If they require more, would you advocate that Government should give some supplementary allowance in addition to this title? Would you suggest Government should pay something in cash?—I doubt whether Government could afford to do it.

2266. You would not go so far as that in your suggestion?—No. I merely suggested that to encourage the Brahmin and the Moulvi to take an interest in primary education they should be given by Government some honorific title.

2267. Do you think a mere title would suffice to get people to do this work in the villages?—Mere titles attract people to do quite a lot of things.

2268. *Mr. Calvert*: Do these figures you have given us refer to all-India or to British India alone?—If you refer to the figures relating to Post Offices, they refer to that part of India where the department operates.

2269. The attitude of your department towards co-operation might be referred to as distinctly helpful?—Yes, I hope so.

2270. Where we have tried to organise co-operative post offices you are always prepared to assist?—Yes.

2271. And you are usually prepared to take them over if they prove a paying proposition?—Do you organise post offices?

2272. We organise them and if you see they pay, you take them over?—Have you done so?

2273. Yes?—I do not know anything about these co-operative post offices.

2274. You have taken them all over. The moment we started them you took them over?—Was that in the Punjab?

2275. Yes. In Bombay the same thing has occurred?—I do not remember it in Bombay.

2276. You informed the Chairman that the post office savings business is done on behalf of the Finance Department. It is really not your work; it is Finance Department work?—Well, it must be the Finance Department's; it is done for the Government of India.

2277. So that really any difficulties found by co-operative societies from the existence of your post office savings bank should be addressed to the Finance Department and not to you?—Certainly not; we are the managers of the savings banks, and any difficulties should be put before us.

2278. You do not levy any stamp duty on withdrawals from the post office savings bank?—No.

2279. Would you be prepared to levy that duty in order to remove this concession in your favour?—I do not think so.

2280. It is not enjoyed by co-operative societies. A depositor in a co-operative society who withdraws more than 20 rupees has to get an anna stamp from the post office?—Would it not be better to get the Finance Department to agree to forego the stamp duty in your case? It is very difficult to deprive a man of a privilege once you have given it to him.

2281. I do not know whether they would do that. As far as your department is concerned, is there any opposition to the thrift movement in co-operative societies?—None that I am aware of. I have never heard of it.

2282. There used to be?—I have never heard of it.

2283. The post office or the Finance Department, one of the two, attempted to prevent co-operative societies from undertaking this savings movement?—I cannot say whether that is a fact or not.

2284. Opposition, there definitely was. That has now disappeared?—We have always tried to help, to the best of my knowledge. Wherever I have been as Postmaster General I have never in any way opposed the co-operative movement; in fact, I have always tried to help as far as I could.

2285. You actually do help?—To the best of my knowledge, the policy of the department is in no way opposed to the co-operative movement.

2286. Actually your savings branch does help co-operative societies by taking their accounts as public accounts. You give them some privileges in that way, but there was opposition to our taking deposits from non-members or paying higher interest than you pay?—There may have been some technical objection. I cannot remember the case sufficiently. To the best of my knowledge, our policy has never been against co-operative societies. There may have been, as I say, technical objections of some kind to various points in the co-operative thrift movement.

2287. We have always found you extremely helpful, but the situation in the last few years has changed; i.e., the co-operative thrift movement is now a bigger thing than the post office savings bank. Your present attitude of helpfulness is likely to continue?—Yes.

2288. Do you charge the same money order commission irrespective of the distance of remittance?—We charge a flat rate.

2289. Is it quite impossible for you to charge a lower rate for remittances inside a district?—I should not say it was impossible; the matter would have to be carefully considered. We try as far as possible in the post office to avoid complications. We have a flat rate of postage for the whole of the Indian Empire and a flat rate of money order commission. We have found that such a system is better for us than having variations.

2290. You know, of course, that in several Provinces money is being remitted between co-operative societies at 4 annas per cent, instead of 1 Rupee, the balance being paid by the Provincial Governments?—No. I am not aware of it.

2291. That is spreading. Would not you yourself like to consider under taking this remitting of money orders in the district?—I cannot say. If it is put to us as a recommendation we shall be glad to consider it, but what the result will be I cannot possibly foresee.

2292. *Professor Gangulee*: Can you give us an idea of the parcels of seeds carried by the post office, the number of such parcels?—No. We have no statistics specially for seeds.

2293. You are aware of the way such packages are packed. Some people are not at all careful in the way they pack seeds for transport?—I cannot say.

2294. You do not take any special precautions against damage?—No. Each person is responsible for the packing of his own parcels, and if he packs them badly it is his own lookout. The only instance where we insist on security is in the case of insured articles, so that they shall not be liable to tampering. If, for instance, a lady posts a hat in a flimsy cardboard box and it is smashed, that is her affair.

2295. I understand that, but we are concerned here with the supply of seed to the agriculturists?—We do do that. The seed traffic, as far as I know, is not very important from our point of view; in fact, we have no statistics of it. We cannot tell what is in an inland parcel; the contents are not declared.

2296. You agree the post office could be utilised for the distribution of better seeds?—Certainly, if they are put into envelopes or boxes and posted.

2297. In that case would the post office be prepared to take precautions against damage?—No, certainly not. The onus is on the sender, not on us.

2298. I am anxious to get this point quite clear, because for the village agriculturist this question of parcels of seeds is most important and the service you can render him is great. Suppose the seed trade in this country develops and suppose a great many seed packages go through the post office, would you be prepared to make special arrangements and take special precautions against damage?—Certainly not. I have told you the post office does not take precautions; it is for the sender to take precautions himself. A parcel is handed to us; we do not know what is inside it; we are asked to take it and deliver it somewhere, and that is what we do.

2299. Suppose you know it contains seed?—Even then the onus of packing is on the sender and not the post office. We would never undertake that responsibility.

2300. You would not give any special rates for a parcel of seeds if you knew they contained seeds?—No.

2301. Is the V. P. P. system popular among the rural population?—I do not imagine it is. Do you mean as receivers of V. P. P. articles or senders?

2302. Both?—No, the bulk of the retailing is done in the bigger towns and with better class people who order things V. P. P.

2303. And so far as the rural population is concerned, your V. P. P. system does not concern them?—Not much, but it is there if they want to use it.

2304. Is there no possibility of increasing the rate of interest in the savings bank with a view to encouraging depositors?—That is a question the Finance Department must answer; they fix the rate.

2305. In which Provinces are savings banks most popular?—The average number of depositors in the bank is highest in the Punjab, 275; then comes Bengal.

2306. Can you explain this difference?—No, the Punjab is more literate than Bengal I think.

2307. Do you explain this difference on the ground of literacy?—No, not altogether. The Punjabi is, I think, an enterprising kind of man; he has a lot of sound common sense.

2308. Has the growth of the co-operative movement in any way interfered with your savings bank?—No, it has not.

2309. Is it likely to?—I do not think so; we do quite a different class of business; we take very small deposits. The savings bank is not intended to be used as a current account. We find our figures are going up steadily every year.

2310. So that you think the co-operative credit movement will not interfere with your savings bank?—No, I do not think it will.

2311. Following up the Chairman's suggestion as to disseminating news through the post office, is it possible to organise the post office as a community centre, i.e., connecting the post office with the village schools or the village hall, and thus making the post office a means by which you not only serve the population as you do at the present moment by giving them parcels of seeds and things of that sort, but also by giving them news, and perhaps, when broadcasting is popular, having a little hall in the post office utilised for that purpose as a communal centre?—If you have seen a village post office, you will appreciate that there is not much room for it to become a social centre.

2312. No, but could it be developed in that way?—I do not think it is for us to do it. If the district authorities like to do it, it is for them to do it and not us.

2313. Do you think such a movement would make your post office more popular in the village area?—I do not think so. We are always ready to help any movement that we are required to help, but I do not think it is for us to start social centre movements.

2314. No, but supposing a movement like that is started, you agree that the post office then would be a very suitable agency for the dissemination of such knowledge as is suggested by the Chairman?—No, I do not say that at all. In many post offices the Postmaster would simply not have time to devote to social culture. In the smaller i.e., in the branch post offices he would not have the education to do it. In small branch post offices the Postmasters are promoted postmen; they have not the education of a *patwari*.

2315. You have in some cases combined the offices of village postmaster and village schoolmaster?—Yes, that is where the village schoolmaster undertakes to do the postmaster's work; but he is a schoolmaster first and afterwards a postal official.

2316. Do you take any steps to encourage the use of quinine?—Not specially, we have it for sale and the villagers know perfectly well that they can get the best quinine at the post office, and they buy it.

2317. I see that in the Central Provinces and the United Provinces you adopt the policy of utilising the post office for the receipt of the salt revenue? Do you think that the policy is a sound one?—Certainly; it is about the only vehicle by which the salt can get to the people. So far as I know, the dealer who wants to get salt gets the permit from the post office, pays the tax on it, and then gets it from the Government; that is a convenient way of doing it.

2318. *The Raja of Parlakimedi*: Upon what principle do you promote the different grades of postal offices?—We have no absolute rule. Directly a branch office, for instance, is doing a considerable amount of work, the Superintendent of the division recommends that it shall be turned into a sub-office, so as to be of more use to the people of the locality. A head office simply means that the accounts work of a certain area is done in that office. So far as the public is concerned a head office does not do any more nor any less postal work than a sub-office, but it is the accounts centre of an area. Very often people make that mistake; they say: "We are a very important place and we ought to have a head office." That is nothing to do with it; a sub-office does exactly the same work as a head office.

2319. Does it not depend upon the business it has to carry on?—Not in the case of a head office. As I say, we usually have a head office in the chief town of a district chiefly because the treasury is there. Other offices are subordinate to it and send their accounts in to that head office; but as regards the postal work itself the head office and the sub-office are on an equality as regards the public. The public can get the same attention from the sub-office as from the head office: they do the same work.

2320. What do you think of the idea of entrusting savings bank business to headmen who are members of local bodies who are prepared to give a certain amount of security?—That is a thing we have never even contemplated so far. I cannot say that it would be impossible, but I would not like to say off-hand that it is possible. The savings bank system is part of the post office system. I think that it would perhaps be impossible to give the powers to the headman of a village.

2321. If he is able to produce a certain amount of security?—Of course he must do that; but I would not like to say “yes” or “no” to that question.

2322. Do you not think the postal office should adopt some concession rates for circulation of agricultural bulletins?—No, I do not think so. We give concession rates to newspapers; that is to say, a Press can send a newspaper weighing up to 8 tolas for 3 pies. If the bulletin can be brought within the description of a registered newspaper, then of course it can go for quarter of an anna.

2323. *Sir Ganga Ram*: Do many people take advantage of your system when remitting their revenue?—In certain Provinces, not in all Provinces.

2324. Altogether in India do you do much business in revenue money orders?—No, not very much as far as I know.

2325. You charge them the same rates as ordinary money orders?—Yes, I think so.

2326. Do you not think it would pay you to reduce it?—I do not think we could reduce it below 1 per cent.

2327. Has there been a substantial diminution in your work in the rural areas since postal rates were increased for postcards and so on?—I cannot say how far it was in the rural areas. There was of course some reduction in the traffic as a whole, but I cannot say whether it was specially in the rural areas. Probably not, because the bulk of the traffic comes from the large towns, and as I have pointed out in my reply to the Questionnaire there is only an average of 4 postal articles per head of the whole population. In the rural areas it probably would not be as much as 4 in actual fact; it would probably be 3 or 2. I really doubt therefore whether the enhancement of the postage has made much difference to the rural population.

2328. *Dr. Hyder*: You have given us a very interesting table of these postal cash certificates. You know that hoarding is a great evil in India?—Yes, I suppose it is.

2329. The only agencies provided by the Government so far have been the savings banks, these postal cash certificates and the co-operative society; is not that so?—No, there are the various Government loans; people can invest in the Government issues.

2330. Take the case of Burma, the cost price realised on all these certificates is Rs. 10,63,000?—Yes.

2331. The various shares are 773 pieces of the face value of Rs. 1,000, and so on?—Yes.

2332. Analysing these figures, I find that the bulk goes to people with larger means; is not that so?—Looking at the figures, it appears to be the case.

2333. I mean out of this total of 10 lakhs realised, Rs. 5,79,000 are held by people of larger means. So would it be right to say that the bulk of this investment is by the comparatively larger men and not the smaller men?—Looking at the figures I should say it was the case, because the favoured

amount seems to be Rs. 100; the next biggest is Rs. 500, and after that Rs. 1,000. The lower dimensions do not seem to be so popular. I think the inference is that the bigger people invest in this.

2334. The educated people and people living in the towns?—Yes, people who have got the money to do it.

2335. You have no figures in your possession as to the investment made by the rural people in these postal cash certificates?—No; I could get them; I have not got them here with me. It would however be difficult unless we know how many cash certificates were bought, say, in the more or less rural sub-offices. It would be very difficult to say when a man comes to a head office whether he is an agriculturist or whether he is a shop-keeper.

2336. I was wondering whether such figures were available in order to throw some light on the question whether the rural population is giving up this ancient practice of hoarding, so that more money is available for agricultural improvements?—I do not know.

2337. *The Chairman:* Is there anything else you wish to say?—No.

(The witness withdrew.)

The Commission then adjourned till 10 a.m. on Monday, the 18th October, 1926.

Monday, October 18th, 1926.

SIMLA.

PRESENT:

THE MARQUESS OF LINLITHGOW, D.L. (*Chairman*).

Sir HENRY STAVELEY LAWRENCE,
K.C.S.I., I.C.S.

Sir THOMAS MIDDLETON, K.B.E.,
C.B.

Sir JAMES MACKENNA, Kt., C.I.E.,
I.C.S.

Mr. H. CALVERT, C.I.E., I.C.S.

Raja SRI KRISHNA CHANDRA
GAJAPATI NARAYANA DEO of
Parlakimedi.

Professor N. GANGULEE.

Dr. L. K. HYDER.

Mr. J. A. MADAN, I.C.S. }

Mr. F. W. H. SMITH. } (*Joint Secretaries*.)

Sir CLEMENT HINDLEY, Kt., Chief Commissioner of Railways.

Memorandum by the Railway Board.

(1) *Refrigerator Vans.*

The question of the use of refrigerator vans on Indian Railways first received attention in the year 1908 when Captain Freeland, an Indian Railway Officer, was deputed to attend a Conference on the subject at Paris and submitted a report. The possible methods of reducing the temperature in railway vans are:—

- (a) the use of refrigerating machinery in the van, worked either by a small engine or off the axle,
- (b) the use of insulated vans which are cooled either in a cold storage shed or by the introduction of ice, and the low temperature maintained by ice bunkers.

In this note the term "refrigerating van" is used to describe the former type and "insulated van" to denote the latter.

Conditions in India were at the time considered unfavourable for the introduction of either description of van. Three years later, in 1911, the Railway Board were approached by the Bengal Fisheries Company in connection with the conveyance of fish in refrigerator vans. Designs were got out by the Eastern Bengal and the Bengal Nagpur Railways, but the Company failed to develop the proposal.

2. Inquiries as to the possibilities of fruit traffic such as would require refrigeration, made in 1912, showed that from one of the most promising localities—the Frontier at Peshawar—only some 30 tons of fruit per day would be available for 3 months in the year and out of the 3 months only during one month would actual refrigeration or cooling be required.

3. Inquiries were, however, continued with a view to seeing whether the fruit traffic could be developed and what was required and the assistance of Mr. A. Howard, Imperial Economic Botanist, was sought. Mr. Howard favoured the railways with a memorandum on the subject the substance of which was as follows:—

The special conditions attaching to India were that the fruit had to be carried considerable distances through hot and humid regions; that the trade was in the hands of small traders who

did not combine, with the consequence that the packages of fruit booked were small and in miscellaneous shapes and sizes, while the method of packing was primitive. No large business existed and cheapness was essential. No market for high class fruit existed, as for example, in the United States. The results of experiments carried out at Pusa and Calcutta had shown that Bihar peaches, if properly packed, would last 72 hours in the hottest season without damage, though no ice was used. It may be noted that the conditions described by Mr. Howard probably continue very much the same as when he wrote in 1913. A special enquiry, however, regarding the amount of traffic offering and facilities for the transport of fruit on Indian railways is being made and will be the subject of a separate memorandum.

4. The question of refrigeration was discussed by the Railway Conference in 1913 and they came to the conclusion that there was no demand at present in India for refrigerator vans, but that railways should experiment with special fruit vans. Certain suggestions put forward by Mr. Howard for the improvement of the fruit traffic were carried out, namely, the free return of improved types of boxes used in packing, and charging consignees on the collective weight instead of for individual packages.

5. The North Western Railway was meanwhile experimenting with a form of insulated van, and inquiries were instituted from the Consulting Engineers in England and firms in India as regards the design of refrigerator cars and machinery. The opinions received were all adverse to refrigerator cars owing to loss of space, haulage of extra dead weight, difficulties of examining running machinery *en route*, difficulties of keeping the temperature low while the van was stationary, if the alternative of working machinery from an axle was adopted.

6. In the meantime the Great Indian Peninsula Railway had introduced a special refrigerator car, intended to keep consignment cool and fitted with an apparatus for cooling carriages on trains. In 1916 the Great Indian Peninsula Railway car and the North Western Railway insulated vans were transferred to the Eastern Bengal Railway with a view to carrying out further experiments. The result showed that the Great Indian Peninsula Railway car was a failure and that the North Western Railway vans were not sufficiently insulated.

7. The Eastern Bengal Railway were then instructed to build new types of insulated vans and a successful van was constructed. The result of the experiment on the Eastern Bengal Railway was set out in a press communiqué, dated 6th October 1917, a copy of which will be found at page 308.

8. At the same time all railways were addressed by the Railway Board to consider sympathetically any reasonable proposals to provide an experimental service of insulated vans and were encouraged to provide cooling rooms at the points at which traffic might originate. Local Governments were also addressed asking for their co-operation and for meetings to be arranged with railways with a view to ascertaining what measures could be taken to promote such traffic. The Local Governments were practically unanimous in their opinion that the proposals could not be made remunerative and that there was at present no demand for refrigeration. Interest, however, on the subject was displayed at Bombay and Karachi and further endeavours were, therefore, made to establish a service between certain particular points—Bombay to Ahmedabad, Bombay to Poona, Karachi to Lahore, Karachi to Delhi—but nothing developed.

9. In this connection the conclusions of the Honorary Director of Madras Fisheries on the subject may be quoted:—

“(1) I am not certain that, except for the shoal fish of the West Coast and northern parts of the East Coast, fish are really abundant in our seas, specially fish of the better classes;

- (2) Even if abundant they will not be caught abundantly for many years to come by reason of the conditions of the fisher-folk, the want and cost of bigger boats, etc., motors, etc., and want of harbours and artificers;
- (3) If caught they would on reaching shore often be of questionable or worse condition unless we have large boats, ice, motors, etc.;
- (4) Capital and enterprise will hardly be found to establish an ice factory without an assurance of a large and sound fish supply, or a fishing fleet without a prior ice factory; even if point (1) is established, capital would require to start an ice factory and fishing fleet in co-operation;
- (5) The expenses of fleet and factory in this climate would be very heavy owing to climate, cost of ice and superintendence, etc., so also the cost of transport, distribution, etc.;
- (6) Hence the cost of fish would prohibit the fish in question from reaching the masses;
- (7) Nevertheless it may be possible, in certain exceptional areas, to freeze and chill masses of the frequent surpluses of shoal fish so that they may reach a larger market than at present and in better condition, at quite moderate rates;
- (8) But for the 'masses' properly so-called, who consider one anna per pound of dried fish a quite sufficiently high price, iced or fresh fish is out of the question for many years."

10. In the meantime the Eastern Bengal Railway endeavoured to popularise the use of the new type of insulated vans, ice cooled, for the fish traffic between Goalundo and Calcutta; but this failed owing to the fact of the traffic being widely distributed, and no cold storage being available at destination even at Calcutta. These vans were subsequently transferred to the North Western Railway for the carriage of fruit.

Particulars had also been obtained of types of vans used on the L. and S. W. Railway in England and in Australia and it was ascertained that only insulated vans were used in England and Australia and no attempts made with cars containing refrigerating machinery.

11. In 1919 endeavours were again made to establish refrigerated traffic in consultation with the Lightfoot Refrigeration Company who were called on to prepare schemes for fish traffic between Goalundo and Calcutta, Bombay and Poona, Karachi and Delhi and for fruit traffic between Peshawar and Delhi. But this only resulted in an offer from the Company for the sale of oil-driven refrigerating vans.

12. Ice cooled insulated vans were, however, introduced on the B., B. and C. I. Railway and on the East Indian Railway, but though private cold storage existed to a limited extent local bodies could not be got to take up the subject.

13. In 1921 Major Sir Edward Every approached the railways with a view to the formation of a Company for the construction of coastal depôts and the introduction of an inland service. The railways agreed to allow the Company the privilege of owning cold storage vans subject to the right of the Railway Board to take them over at a valuation at the end of 5 years. The Company then endeavoured to obtain, from the Secretary of State, sanction to the issue of a prospectus which implied that they were being given special privileges in the shape of sites of military and railway land and that fish rations were to be issued for troops. This could not be agreed to and nothing more was heard from the Company.

14. It will be seen that speaking generally the results so far have therefore been limited to the use of ice cooled insulated vans for the carriage of more delicate kinds of fruit, chiefly on the North Western Railway. The extensive use of refrigerator or cold storage vans depends entirely on the creation of a suitable traffic and the establishment of cold storage depôts at suitable market points. Such cold storage depôts have to be run on

commercial lines and involve setting up a regular business which depends on supply and demand and constant touch with marketing. For this reason the railways have not undertaken the establishment of cold storage depôts, though, as already stated, they were prepared to establish such depôts at the points of origin of the traffic. To a small extent private cold storage depôts exist at Calcutta and Bombay but until railways are satisfied that there are cold storage depôts established up-country they cannot undertake to provide refrigerator or cold storage vans. If the demand arises there will be no difficulty in providing and running such vans and it may be added that the railways are anxious to undertake any form of transportation work if it can be shown that a demand exists and can be developed into a commercial success. It should, however, be noted that it is open to question whether State-managed railways would be justified financially or as a matter of policy in undertaking the whole enterprise of the cold storage business.

Communiqué, dated 6th October 1917.

A commencement was made with a refrigerating van which had been in use for the short time on the Great Indian Peninsula Railway together with a number of insulated vans which had been built and placed in traffic by the North Western Railway. The Great Indian Peninsula Railway van was a self-contained freezing plant with, in addition, a compartment for the carriage of perishable articles in cold storage. The North Western Railway vans had no freezing apparatus. They were provided with a measure of insulation with the object of maintaining the vans at an even temperature and with compartments for the reception of ice to produce a suitable low temperature.

Soon after the commencement of the experiments it became evident that a system which called for the provision of freezing machinery in a vehicle could not be expected to be satisfactory or remunerative having regard to the large number of installations which would be required to deal with any considerable volume of traffic, the loss of space, the difficulties and cost of maintenance and the large amount of additional dead weight which must be hauled. Moreover, experiments with the North Western Railway insulated vans proved conclusively that the method of insulation adopted for these was not the most suitable for the Indian climate and could not be depended upon to maintain the vans at a low temperature. It was decided therefore to build a number of new experimental insulated vans cooled by chambers filled with ice. To determine their efficiency and ascertain their financial possibilities, the considerable fish traffic, which moves from Sara and Goalundo to Calcutta, was selected as being suitable for the trials of these vehicles.

At the same time the carriage of fruit in cold storage was considered. There are prospects of a considerable demand arising for this class of accommodation but a different type of vehicle is required, as, apart from temperature, the carbon dioxide given off by fruit hastens its decomposition. Provision has, therefore, to be made for adequate ventilation, and, for the trials, certain of the North Western Railway insulated vans were rebuilt to a modified design fitted with ventilating appliances.

The first step in the experiments was to ascertain the best form of insulation. Many substances have been and are used for this purpose, and it is generally considered that cork slab is one of the most efficient insulating materials. This, and many other insulators were tried with varying results, but it was found that having regard to the three factors—weight, non-conductivity and cost—none could be considered entirely satisfactory. Moreover, there was the further disadvantage that cork slab was difficult to obtain in sufficient quantities. Investigations were made, therefore, as to the possibility of obtaining some substance which is indigenous to India and at the same time an efficient insulator. After experiment, the choice fell on the variety of cotton tree known as *Simul* (*Bombax Malabaricum*) which is common in India and which proved a more efficient

insulator even than cork. It is cheap, light in weight, and can be procured in large quantities. Further, and an important point, it is only slightly absorbent of moisture, the exclusion of which is necessary to efficient insulation.

Four types of cold storage vans were constructed and one was later modified to a fifth type. The insulation generally consisted of some 12 to 8 inches of non-conducting material. Ice compartments were provided at one or both ends of the vehicles and both in the stationary trial, before the vans were put into traffic, and in the actual traffic trials, the circulation of air over the ice and through the van was induced by electric fans. The fourth type was constructed with *Simul* as an insulating material, and in the trial prior to the vehicle being brought into traffic, the temperature of the van was reduced from 90° F. to 48° F., i.e., 42° F. in 24 hours; the "heat leakage" or rate at which the temperature of the van increased on the exhaustion of the ice supply was 1° in practically 4 hours.

The type of van now evolved is thoroughly insulated and suitable for the carriage of fish and other perishable commodities which do not require ventilation in cold storage. For long distance traffic it is considered that electric fans may be omitted, the natural circulation of the cooled air being sufficient.

The present method of despatching fish by rail from Goalundo to Calcutta in the hot weather is to pack fish mixed with ice into baskets or boxes, the ice required being obtained from Calcutta. This entails considerable loss *en route*, and in addition to the wastage of ice a proportion of the fish may arrive at destination in a stale condition. The consignments of fish booked in the experimental vans reached Calcutta in excellent condition and, in one case, in which fish was kept in the van for a trip from Goalundo to Calcutta and back again to Goalundo, a period of about 40 hours, it was found to be still in fresh condition and fit for human consumption.

The cold storage fruit vans referred to above have also been put under trial both in the railway shops and under actual traffic conditions. In the stationary trials two selections of mangoes, peaches and plantains in a thoroughly ripe condition were subjected to trial in the insulated fruit van and in a ventilated box, respectively.

The conditions to which the fruit in the box was exposed were made as nearly as possible similar to those under which fruit travels in louvered vans. The trial ran for 4 days when the fruit in the van was found to be in excellent condition while that in the box had rotted. A trial consignment of peaches and grapes was then consigned in this van from Peshawar to Howrah. The full consignment arrived in excellent condition, none of the fruit being lost through damage or decomposition. The experience of the fruit dealers with their consignment of the previous day in ordinary vans in which 73 per cent of the fruit despatched decomposed and rotted *en route* may be quoted by comparison. Under ordinary circumstances the loss of fruit in transit by deterioration amounts to from 12½ to 50 per cent of the consignment according to the speed of the train by which it is booked. The experiments with these fruit vans are continuing.

The question of providing facilities which will make available in increasing quantities throughout the country perishable products, such as fruit from the North-West Frontier and fish from the coasts of India, is an important one. Experience in other countries shows that improvements are always being made and that the last word has not yet been said on the subject, but so far as transport over the railways is concerned, it can be claimed, as the result of the experiments detailed, that the matter has now been put on a sound practical footing. What remains is to improve the methods of dealing with such products at the despatching and receiving points. To take the fish traffic, for instance, under present arrangements, the fish after removal from the boats may be left in a hot atmosphere for some hours, and it is desirable to provide some form of cooling room into which the fish can be taken direct from the boats. It is

proposed to provide a place of this kind at Sara for the fish traffic over the Eastern Bengal Railway to Calcutta, and similar facilities will no doubt be provided by railways at other points where they are found to be necessary. As regards the points of destination, it is desirable also that cold storage rooms should be set up in the markets themselves or other convenient places, and it is the intention that this matter should be taken up with the local authorities concerned.

(2) *Grain Elevators.*

The question of grain elevators was taken up in 1908 and extensive enquiries made as to the possibility of their introduction in India. The possible use thereof is chiefly connected in India with that of the transport and storage of wheat, and it was in connection with the export traffic of wheat from the Port of Karachi that the question has received particular attention.

2. The construction and use of elevators was investigated on the North Western Railway by an informal committee appointed in 1909, and the main difficulty experienced on the railway in connection with the export traffic at the time was the concentration of the traffic over a short period and the consequent difficulty in providing sufficient accommodation and rolling stock. In this connection the committee found that the establishment of elevators would undoubtedly tend to the quicker turn round of railway rolling stock (and this applies to ships also) but that, owing to the particular conditions of the trade, no hope could be entertained of spreading the traffic more evenly over the year. This was due to market demands necessitating the export of Indian wheat during 3 months, from about the middle of May to the middle of August. As regards the local movement of wheat the committee found the traffic less concentrated, that for storage purposes wheat owners were satisfied with the arrangements existing and that there was no prospect of the use of elevators.

3. The proposal also, to erect elevators, received no encouragement from the exporters interested in the export of wheat. Under existing conditions such exporters have a virtual monopoly as, without the facilities which such exporters have created for themselves, smaller firms cannot intervene as they might with a system of elevators. But undoubtedly the objection, or rather the indifference, of the exporters to the subject of erection of elevators is mainly an economical one. Under the climatic conditions prevailing at Karachi wheat can, without serious damage, be stored and dealt with in the open very cheaply for certain months in the year. Little capital is involved comparative to the capital necessary for an elevator system and this small lock up of capital is an important factor, in consideration of the fluctuating nature of the traffic year by year.

4. As regards the Karachi Port Trust, who are intimately concerned with any proposal regarding the establishment of elevators in connection with the export trade, the attitude of the Port Trust is stated in a note of the Chairman written in October 1917, which reads:—

“Then, again, we have the elevator question to consider. We have practically bound ourselves to introduce this when the demand comes. We are telling His Excellency the Viceroy so in the Address we are to present on the 30th of this month, and we have repeatedly stated that we recognise the obligation.”

In the absence of demand no experimental action has been taken by the Port Trust, but they have expressed their willingness to grant facilities to any private company which will undertake the construction of elevators; no such company has, however, come forward.

5. This question of whether grain elevators are required or would be beneficial is interlinked with questions of marketing, and the difficulties in the past have, probably, been the number of divergent interests concerned. The wholesale dealers, the growers, the railways, the ports and local business interests are all involved. So far the only result of previous

consideration of the problem has been the abortive construction of an elevator at Lyallpur and the decision of the Karachi Port Commissioners, already quoted, that they would be prepared to erect elevators "when the demand comes".

6. From the railway point of view the introduction of elevators would tend to economy in working by the introduction of transport in bulk, quicker turn round of wagons and possibly a better distribution of the traffic throughout the year. The railways would, therefore, welcome and assist, in every reasonable manner, the introduction of such a system, but it is obvious that they are not in a position to do anything without the co-ordination of the other interests concerned.

7. Before elevators can be introduced it must be determined what form of elevator is suitable to the country. Grave objections have been raised to any proposal for public elevators owing to doubts as to the suitability of Indian wheat for grading purposes, and as to the possibility of the introduction of any system of grading and issue of certificates which would not be liable to serious abuses. It must also be borne in mind that even if railways were to build public elevators they must either hire them out to a company or enter into commercial undertaking outside the ordinary scope of railway work.

8. The Punjab Government suggested a meeting to discuss the question with the North Western Railway Administration and the Karachi Port Trust in the cold weather of 1924-25. The latter body, however, considered that no useful purpose would be served by such a meeting on the grounds that no new developments had arisen since the matter had been last discussed as there had been no demand from the trade for the erection of elevators at Karachi.

9. The North Western Railway are, however, considering the possible developments that may arise as regards the wheat traffic on account of the Sutlej Valley and Sukkur Barrage schemes of irrigation now in process of construction. In anticipation of such developments a special officer has been deputed by the North Western Railway to look into the question of improving railway facilities generally and in the port areas at Karachi in particular. In this connection particular attention is being paid to the question of the possibilities of the handling of the Punjab wheat traffic, through elevators, at the principal market stations and at Karachi port and endeavours are again being made to enlist the assistance of the Punjab Government and the Karachi Port Trust.

Oral Evidence.

2338. *The Chairman:* Sir Clement Hindley, you have been good enough to prepare some material which is before the Commission and for which we are greatly obliged. Would you care to make a statement of a general nature before we proceed to ask you any questions?—I thought it might be useful to the Commission if I gave a short indication of the scope of the Indian railways, their geographical position and their principal business. I can with a map give a rough idea of the lie of the railways.

2339. I think that would be most useful?—I wanted to explain how the railways of India have grown up and why they are in the position in which they are at present. The main trunk lines have been gradually built up roughly in accordance with a note which Lord Dalhousie wrote in 1853 when he was studying the question of railway communications in India generally. He suggested that what was required was trunk lines to connect up the various Provinces amongst themselves and with the ports. On the basis of that formula he indicated that the future trunk lines of India would probably be, first of all, between Calcutta and the north-west of India along the Ganges valley, between Madras and Bombay and between Madras and the Malabar Coast. These were the three principal lines he looked upon as being necessary, and further a line from Bombay to the North-West of India. That skeleton which he laid down is really the basis on which the railways at present are built up. The most important one from the traffic point of view. The one that was mainly constructed before most of the others, is the East Indian Railway, which runs along the Ganges valley. It was originally constructed practically parallel to the river right away up, touching Benares and Allahabad, eventually reaching Delhi. That followed one of the most ancient trade routes of the world, through the Khyber Pass to the sea down to the neighbourhood of Calcutta. Of course, the Ganges valley, being very thickly populated, provided a great deal of opportunities for small connections and branches, but an interesting fact which I would just like to mention is that whereas the railway originally ran by a somewhat circuitous route along the river, it has by successive short circuits been brought into this route which runs direct from Calcutta almost in a straight line to Delhi. Not more than 20 years ago the final chord line was made. That is rather interesting historically. The first chord was from Asansol to a point called Lughiserai; that was done about 1870. The second line ran from the same point, which is in the coal-fields, Asansol, through Gaya practically to Benares, reducing the distance again by about 50 miles. The present chord line we are building is primarily to serve certain coal properties in Central India and will eventually form a shorter route to Bombay. I have mentioned the main axis of this great trunk line, the East Indian Railway, running south of the Ganges to Delhi and connecting with the later lines which were built in the Punjab from Delhi to Peshawar. Then about the same time as construction was started on this side, construction was started from Bombay on the line which now runs to the cities of the Gangetic plain from Bombay. In the recent reorganisation which we have made of the limits of certain railways we adopted the principle that the larger towns in the Gangetic plain beginning with Allahabad and Delhi should all have direct connection with Bombay. We have now given the Great Indian Peninsula Railway, which is based on Bombay, jurisdiction right up to those towns; those towns therefore enjoy direct communication with Bombay and Calcutta, the two big import centres. Then take the North-West of India, the Punjab and the North-West Provinces. Lines were started in continuation of the East Indian Railway, to connect Lahore and later on to connect Peshawar. That network of railways on the frontier was built very largely for strategic reasons in the first instance, but some of these railways are gradually becoming commercial railways. The line was connected up across the Punjab to connect up with Sind and Karachi. That is the origin of that route, which gives Lahore the advantage of proximity to the port of Karachi somewhat similar to its distance from Calcutta. Then later on, partly for strategic and partly for administrative reasons, these

lines were built into Quetta, and quite recently, during the War, this line was built across the Baluchistan Desert to Persia. You see the great network of lines running down towards Karachi. Those lines lie in that direction because they lie between the five rivers of the Punjab; they are practically on the watersheds of five great rivers which connect up with the Indus. They have mostly been put through Canal Colonies where irrigation has been introduced for improving crops. These railways all form links which bring the crops, wheat mainly, down towards the great ports. Incidentally I may say that the Sukkur Barrage which is now under construction in Sind will improve the crops and agriculture generally in this area, and we are arranging for the construction of certain feeder lines to serve that part of the country. For many years the main connection between Calcutta and Madras lay across this route: it was only in comparatively recent times, 25 or 30 years ago, that this East Coast railway was built down the coast of Orissa; that is a subsequent main trunk line. The lines in Southern India depend primarily on the connection between Bombay and Madras, that is the main trunk line. There have been subsequent lines built from Madras down to the Malabar coast as predicated by Lord Dalhousie. The process, as I have tried to indicate, is, primarily, building up main trunk railways along the trade routes, and then filling in the interstices as has been found possible under traffic conditions where profitable business could be done. I should mention that on the northern side of the Ganges there is a great system which has grown up mainly on the metre gauge, called the Bengal North-Western, which serves the area between the mountains of Nepal and the Ganges. Another area which is interesting is the Eastern Bengal and Assam area. We have the Eastern Bengal Railway running due north and south serving the whole of this country. Further to the east we have the Assam-Bengal Railway which roughly follows the line of the river Brahmaputra, but it has this cross-connecting piece of line through the hills to connect up the two main valleys. Burma has an entirely separate railway system based on the port of Rangoon and a main trunk road between Rangoon and Mandalay. That was the original line; there have been various branches put in. We are now projecting a line down the coast here which we hope will eventually connect up with the Siamese State Railways and give direct connection on the metre gauge between Rangoon and Penang and the Malay States. I should like to indicate an interesting thing: we are hoping to connect up on the one side with Penang and Singapore, and we have already a railway on the Persia side, so that there is the making of a great transcontinental route.

2340. I did not catch the link between India and Burma?—There is none at present; surveys are being made at the present moment. There are no insuperable difficulties, but there is no trade at present.

2341. Is that being projected now?—One of those connections is actually under survey and has been under survey during the last cold weather. There have been 4 or 5 surveys made. A line was surveyed hurriedly when the "Emden" was in the Bay during the War. But that is a very expensive route with a very small population, and the possibilities may be more in favour of the other route.

I want to explain now in a few words the system of administration. There are four main systems which are worked direct by the State under the control of the Railway Board. They are the East Indian Railway running from Calcutta to Delhi with its branches, the Great Indian Peninsula Railway running from Bombay to Delhi through the Central Provinces, the North Western Railway which is the largest system of all, based on Lahore and covering practically the whole of the Punjab, Sind and Baluchistan. The fourth is the Eastern Bengal Railway running up from Eastern Bengal on to the borders of Assam. Those are the four railways which are controlled directly by the Railway Board. The North Western Railway has a mileage of 6,200 route miles; the East Indian just under 4,000, the Great Indian Peninsula Railway about 3,600, and the Eastern Bengal 1,700.

2342. *Mr. Calvert*: Does a double line count once or twice?—I am speaking of route mileage: that is the total distance between destinations. We

have a total of 15,500 miles under direct State management, and a total in India altogether of 38,500. Of those 38,500, roughly 28,000 are State-owned, but in some cases worked by companies. 15,500 are worked direct by the State, and the balance are worked by companies, by Indian States, or by District Boards. Then I might take the other systems in order of importance. The Bombay, Baroda and Central India Railway is based on Bombay; it consists of a trunk broad gauge line running up to Delhi, and a large network of metre gauge lines connecting up the States of Rajputana, and running up north into the Punjab. Then there are railways very largely owned and worked by small Indian States. The next big railway is the Madras and Southern Mahratta based on Madras, running half way up the East coast, running half way to Bombay on the trunk route between Bombay and Madras, covering the Southern Mahratta country. The next big system is the South Indian Railway based on Trichinopoly which takes the whole of the balance of the Peninsula here.

2343. *The Chairman*: Is there any break in gauge so far as the main railway system is concerned?—Unfortunately we have two gauges: we have about half and half broad gauge and metre gauge. There are some areas which have been developed almost entirely on the metre gauge. Burma is one. The area covered by the South Indian Railway is practically all metre gauge, and the Rajputana lines are metre gauge. The Bengal and North-Western, north of the Ganges, is also metre gauge. There are consequently a great many transshipment points. Our present policy is to develop as far as possible metre gauge in the metre gauge areas and broad gauge in the broad gauge areas, but wherever possible we are reducing the number of transshipment points. That I think gives the general outline of the railway system.

I might just mention perhaps the principal commodities, that we consider of importance, carried by the different railways. Of course, the North Western Railway is primarily a wheat railway: most of its traffic is derived from wheat in the Canal Colonies. The East Indian Railway carries a great variety of traffic: coal between the coalfields and Calcutta, oil and other seeds between North Bihar and the other Provinces, moving to the port and moving internally, and wheat in the United Provinces. In Assam and Eastern Bengal we have the great jute traffic, and tea from Assam. In Burma we have timber and rice and paddy. The Madras and Southern Mahratta Railway has oil-seeds, cotton and various other crops. The Great Indian Peninsula and the Bombay, Baroda and Central India both move cotton in large quantities, and a certain amount of wheat and other seeds to Bombay. The cotton traffic has recently increased from the Punjab and is finding its way to Karachi. Karachi is the great wheat port. The South Indian Railway deals largely with oil-seeds, rice, ground-nuts, and things of that kind. From the agricultural point of view I mention these commodities. I think that is a rough outline of the position.

2344. Now could you give the Commission some indication of the basis upon which freight rates are fixed in India?—I had better explain the position of the Railway Board and the Government in relation to these railways. As I have just said, 15,500 miles of four big State Railway systems are controlled directly by the Railway Board. The other railways are managed by companies whose Boards of Directors are in London. Under their contracts, the Government of India have the right to fix maxima and minima rates for the carriage of traffic, and we have always applied the same system as we do to control of company railways to the control of our own State Railway systems. The position then is that as a matter of contract, the Government of India prescribe maxima and minima rates for the carriage of goods and passengers on company railways, and, as a matter of administration, on the State Railways.

2345. That is to say the same maxima and minima apply throughout India?—Throughout India, yes. Within those maxima and minima the railway administrations, both Company and State, are left to fix the rates for individual goods; but a classification of goods has been arranged which is

uniform over the whole of the railways; that is to say, all goods are arranged in 10 classes and a maximum and minimum rate is prescribed for each of these classes. Then each company and each State Railway Administration is free to fix any rate it likes within the maximum and minimum prescribed by us, within the general classification. The railways are permitted to put any commodity to a lower class if they wish, but they may not put a commodity into a higher class. If they do take the action of putting a commodity into a lower class, they are still subject to the minimum laid down for the class in which it was originally placed. That is the general basis on which these rates are made. Then, of course, each railway has to study its own business and fix its rates according to the tendency of trade generally. The general principle, I think, adopted is that rates are fixed so as to cause the maximum movement of traffic, subject to the consideration that it is carried at a profit. As I have said, that is the control we exercise from here, and beyond that we do not interfere with the fixing of rates at all; it is a matter which is left entirely to the discretion of the local administration. We have given in our memorandum the classification of agricultural commodities and materials; I do not think I need go into that.

2346. I agree. Would you tell the Commission on what services the terminal charges are based?—The terminal charges, of course, vary a good deal on various railways. There is no general basis I think for the exact fixing of the terminal charges; they are considered to be payment for terminal services rendered, but they are also considered to be legitimate sources of revenue, just in the same way as the mileage rates are considered to be. The whole question of the basis of these terminal rates is at present being looked into and investigated by the Indian Railway Conference Association. They have grown up, of course, locally, possibly on a different basis, but, generally speaking, they are supposed to cover the cost of terminal services.

2347. Do they vary as between various kinds of produce?—Generally speaking they are uniform; there are some cases, I think, where they vary.

2348. Some kinds of produce involve more service at terminal points than others, do they not?—That is so. Take the case, for instance, of minerals; coal is handled in an entirely different way from things like eggs, for instance. The list of terminal charges actually made is on page 7 of our memorandum.*

2349. Do you think it is possible that these terminal charges are a little inequitable as between producers of different kinds of agricultural produce?—I am not aware of any cases of that sort.

2350. You do not think that some forms of produce involve more expensive services than other forms of produce?—Yes, I think they do; I was thinking of it from the point of view of the man who would be likely to complain, and, as far as I know, we have not had any complaints of that kind.

2351. You have mentioned the word "complaints"; I wonder whether you would tell me the position: how do complaints reach the higher branches of the administration?—We have recently established a Rates Advisory Committee which is somewhat on the lines of the Rates Tribunal arranged for in England. That Committee was constituted last May and is at present sitting in Calcutta; it consists of a President who is a legal gentleman, a Railway member, and we have provision for the appointment of a commercial member from panels nominated by the various commercial bodies throughout India. The commercial member was to be nominated for any particular cases which might be brought before the Committee. The Committee has been sitting for the last 4 or 5 months and we have advertised it extensively, but so far, only one case of complaint has been brought before it. The procedure for bringing cases before the Committee is that the complaint must be submitted to the Agent of the railway on which the complaint arises. The Agent of the railway then investigates the case and submits his statement of the case and the original complaint to the Committee for their investigation. He is bound to do so within 3 months. There is an intermediate stage in which both the

*Not printed. Note on "The existing methods of transporting agricultural produce, machinery, manures, etc., and the rates charged on railways" in Central Government Memoranda.

original complaint and the Agent's answer come before the Railway Board, before the Government of India, for decision whether there is a case for reference to the Committee. That was arranged for because it was thought that there might be cases that might be settled without having to come to the Committee, if they came before Government. Then when the Committee makes its finding it is in the form of a recommendation to the Government of India. The Government of India pass Orders on the findings and those Orders in the case of State railways are binding, and in the case of Company railways, by agreement they will be binding. That is the machinery which we have set up, and I would like to bring to the Commissioners' notice that though these facilities for complaint before an entirely unprejudiced tribunal exist, only one very small complaint has so far been brought before it.

2352. I think you have a rule by which a deposit of Rs. 100 has to be made?—Yes, I had not mentioned that; Rs. 100 has to be deposited.

2353. That is as a protection against frivolous complaints?—Yes.

2354. If the complaint is withdrawn within 3 months, the Rs. 100 is returned?—Yes.

2355. What happens to the Rs. 100 if the complaint is adjudged to be frivolous?—We have not had any cases.

2356. You have not made up your mind what you are to do with the money?—I think the intention is that it is to go towards the expenses of the Committee; obviously for cases brought before the Committee it is reasonable that a certain fee should be paid.

2357. Have you through this Rates Advisory Committee had any representations from the Department of Agriculture?—No.

2358. Then, as I understand it, the Rates Advisory Committee has no touch with the Local Advisory Councils; that is quite a different matter, is it not?—They are quite a different concern; the Local Advisory Councils which have been constituted at the headquarters of each railway are to advise the agent in regard to public conveniences and matters affecting the public generally on the railway.

2359. So that a complainant comes straight to the Central Rates Advisory Committee with his grievance; is that the position?—As a matter of form he has to submit them to the Agent of the railway; that is to enable the Agent either to settle the matter direct with him, which might often happen, or to prepare his case and submit it to the tribunal.

2360. It occurs to me that in a very large country like India, a Central Advisory Rates Committee is a very remote object so far as a group of cultivators in any part of the country is concerned?—Of course, any group of people concerned with public traffic have direct access to the local railway officials in the first instance; and if they cannot get a satisfactory hearing there, it is always possible for them to approach the Agent; then if they cannot get satisfaction from him, they can go to the Rates Advisory Committee. It is proposed that the Rates Advisory Committee should hold their sessions in various parts of the country as occasion arises, either in Bombay, Calcutta, Karachi, and so on.

2361. In the matter of facilities for special classes of produce and so forth, how are representations made in that matter?—They are the concern very largely of the local railway officials who are very closely in touch with the people from whom they get their business.

2362. But I presume the policy of all the railways is to develop and encourage new forms of agricultural activity so far as possible?—Yes, I think I can endorse that entirely; we consider that any possible improvements which may be made in agricultural methods which may produce more traffic for us are to be encouraged as far as we can. I think that has always been the policy of the railways.

2363. I have examined the figures so far as they have been laid before us, and I see that a very important proportion of your total business is in agricultural produce?—Yes.

2364. I notice also that your freight rates for grain, for instance, have remained in many cases almost constant since 1913, whereas the prices of

produce have, of course, in that period risen very considerably to the peak of 1919, and have not yet declined to the point at which they stood in 1913, before the War?—Yes, there has been practically no increase in the freight rates of food grains and agricultural produce. It has to be remembered that our expenses have gone up more in proportion to the cost of commodities during that period, and we have had times when it has been very difficult to make our required profit; but we have endeavoured to put the incidence of our necessary revenue on to other things than agricultural produce.

2365. Has it never been represented to you that the facilities granted are in fact difficult to obtain owing to the obstinacy of minor officials or some other causes?—Facilities for booking and sending traffic?

2366. Yes?—Well, I suppose there have been a good many rather general complaints of that kind, but where any definite complaint comes up to us, we always have it investigated very carefully, and I do not think there is any widespread feeling of that kind. It is a matter of course with which the railway administrations themselves are very largely concerned, and I do not think they would allow conditions of that sort to have remained for very long without investigating them. The touch between the railway administration and its clients is a very close one. I do not know that any complaint of that sort would be allowed to go without any investigation.

2367. I suppose the position is that a considerable part of the goods carried by the railways are carried for important concerns which would be perfectly capable and ready to make representations and complaints, and not on behalf of small individual cultivators who might not be able to represent their grievances?—I should think the vast proportion of our traffic is carried for small people, except that the main movements of grain are on account of big buyers very often; but an enormous mass of goods is carried for small merchants.

2368. So that a sensitive and sympathetic organisation for receiving and attending to complaints is very necessary?—Yes, that is so; I think it is extremely sensitive. We have our commercial traffic offices frequently moving about at the principal booking centres, and, what is more, they watch the movement of traffic very closely from headquarters. The local administrators have much greater and closer control over, for instance, the supply of wagons for moving goods, than we used to have, because we have installed telephone communication with practically all the small stations. In the course of what we call train control or traffic control we have now over most of the trunk lines got telephone communications between the district headquarters and every individual outlying station; and on most railways they have introduced the system that all the small stations report every day the quantity of goods lying for despatch which have been received that day; arrangements are then made by headquarters for sending out wagons on the next day for loading these consignments. That has been I think a definite check on the difficulties perhaps experienced by merchants in the past in getting wagons and getting transport for their goods. The position at the divisional headquarters so far as the State railways are concerned, where we have introduced the divisional system, is that each divisional headquarters knows day by day the exact position at each of the outlying stations as regards goods awaiting despatch and the requirements for wagons.

2369. Do you not think that in the case of a small cultivator who wishes to make a complaint, that deposit of Rs. 100 is a very considerable discouragement?—I suppose it would be in the case of a small individual cultivator; but I think we had to protect ourselves against a flood of more or less frivolous complaints. Our feeling generally is that the cultivator can get into close touch with the people who are definitely concerned with moving his traffic, and it is not likely that he will have any serious complaint to bring before this Committee. We were looking rather to complaints of, perhaps, widespread importance; I do not think we ever contemplated that an individual cultivator would have a particular complaint about rates which would be necessary to bring before a Committee of this kind. A group of cultivators might, or the Local Government, or the people who are concerned in agriculture locally,

2370. How do you suggest that a group of cultivators should be made vocal in matters of this sort? They have no organisation, have they?—Well, that is hardly for us.

2371. No, but if I may say so, it is important in relation to your insisting on having a deposit of Rs. 100 in the initial stages of the complaint. Would it not be possible to examine the complaints locally in the first stage, and then perhaps claim a deposit if it is to go to higher authority? I am thinking of the psychological effect?—In actual practice there is no fee for the man who wants to make a complaint locally: he can walk into the Divisional Office and make his complaint there, or go to the Station Master or go to the Traffic Superintendent when he is making his tour. There is no bar, there is every possible means of access for his complaint to be heard, and I think you will find the local officials generally are only too pleased to try and encourage traffic; they have no object in restricting traffic, or making difficulties.

2372. The cultivator is more likely to have complaints about delays in transit and lack of truck facilities?—Well, I do not think there is anybody in India who has got any valid complaint against lack of wagon facilities, certainly during the last two years. I have not heard of any and I should be very glad if we do hear of any to have it investigated.

2373. Are there many complaints of pilfering on the lines?—Yes, we have had a great deal of complaints about pilfering. Pilfering, thefts and damage to goods reached a very high level about three years ago. We have taken intensive measures to protect goods and to look after them better during transit. Various methods have been adopted: we have gone in, in some cases, for walling in our goods yards and marshalling yards where thefts might take place. We have also reorganised very largely our watch and ward staff, and we believe we have made considerable improvement in that direction during the last two or three years. The reason why we have that belief is that our payments for compensation in the case of damages and losses have been very, very heavily reduced. We reached a very large figure indeed in 1921; it has now been reduced to a comparatively small amount.

2374. May I take you back a stage and ask you a question about the constitution of the Local Advisory Committees. I take it the purpose of these Local Advisory Committees is to be a link between the public and the railway administration?—Yes.

2375. Who represents rural interests on the Local Advisory Committees?—The Local Advisory Committees are variously constituted. I am afraid I have not the actual constitutions with me. The Local Government has the right to nominate two members, I think; the Provincial Council nominates two members, and certain corporations and municipalities nominate members. Then I think there are one or two nominations left for Government to make.

2376. I understand that five members representing commerce and trade is the usual number?—I think there is no exact limitation; there is a certain amount of local variation allowed.

2377. So far as I could gather, rural interests were to be entrusted to three members of the Local Legislative Council?—The Local Government also has the power to nominate people.

2378. From outside?—Yes, I cannot say exactly how many; I know in some cases it is two, but we have only laid down general rules for these Advisory Committees and the local railway administrations work within those general rules.

2379. So that you think rural interests are adequately represented on these local councils?—I think so.

2380. The opportunity exists?—Yes, rural interests can be represented under the general rules laid down by Government.

2381. Do you think the facilities for storage at terminal points are adequate so far as agricultural produce goes?—I think so, on the whole, yes. Of course, there is a tendency for the public to assume that it is part of the railway's business to do warehousing; it is always a moot point how far that

is legitimate business of the railway. Generally speaking, I suppose it may be said that we have provided warehouse accommodation where private enterprise has not come forward to fulfil the demand.

2382. Facilities such as shade from the sun for highly perishable produce?—Generally speaking, goods sheds are provided where the weather conditions warrant, that is to say, at the despatch stations and receiving stations. At the big terminal places like Bombay, Karachi, Calcutta, and so on, I think it may be said that very effective arrangements have been provided for housing goods on arrival. Our great difficulty there in most of these places, as I have said before, is that the public assumes it is our business to warehouse their goods, and we have a good deal of difficulty sometimes in deciding to what extent we should provide a covered area to enable merchants and others to leave their goods with us until such time as it suits them under market conditions to take them away: that is a very definite difficulty in regard to the jute business on arrival in Calcutta.

2383. *Dr. Hyder:* Do you not charge demurrage rates?—Yes, they are charged after a certain period of free time. Of course the warehousing business is a very profitable business if we like to undertake it. A great deal is done by private enterprise in these big cities; I have no doubt we could make it a very paying business; but it is not essentially part of our railway business.

2384. *The Chairman:* That is a problem which faces railways all over the world?—Yes.

2385. Is it not the case that it is very often difficult, if not impossible, for concerns other than the railways, willing to undertake storage to get land in close proximity to important railway stations and centres?—That I think is very likely the case.

2386. That has an important bearing on the issue, has it not?—Our land of course is very valuable.

2387. You would be prepared to sell it, but at a price?—Of course, the increment in value of land round about railway properties is a natural phenomenon which occurs everywhere I think; our own property rises in value as well.

2388. Before I ask my colleagues to put to you any questions, I should like to know whether you think that the change in policy in the matter of the financing and construction of branch and feeder lines is likely to have any important effect upon the proportion of branch and feeder lines constructed as compared with main line construction?—Our hope in effecting this change of policy was that there would be a great stimulus to the construction of branch and feeder lines. Under the old policy, where Government guaranteed interest to small companies and District Boards who were constructing lines, in a period of 30 years the total capital raised by companies for building branch lines was a matter of just over 10 crores. At the present time, since we have been able to start a new construction policy based to some extent on this change, we have under investigation at the present time a large programme which we hope will enable us to construct 6,000 miles of new railway during the next 5 years, and at the end of that time we shall have probably 3,000 miles under construction.

2389. Can you give the Commission any indication as to what proportion of that 6,000 miles will be branch and feeder lines, and what proportion main lines?—I am afraid I have not got that; I can get the information.

2390. Can you give it us in the most general way?—I can only say that India is generally very well provided with trunk lines and main and branch lines, and a great many of the lines we are proposing to build now are branch and feeder lines. We have provided the Commission with a map showing the lines that we have under construction at the present time. There are very few main trunk lines that we are considering at all; we are building one from the Central Provinces to the new harbour of Vizagapatam, and we are building the new coalfield lines in Central India; but apart from that I think nearly all these railways are in the nature of branch and feeder lines.

2391. So that it is definitely your view that this change in policy will not involve a reduction in the mileage of branch and feeder lines constructed?—We have already constructed since we made this change, I think, more mileage than the branch lines had built in the previous 10 years. The reasons for this change of policy were set out in a Resolution which was issued in February 1925. I daresay I can give the Royal Commission a copy of that if they have not got it. Briefly speaking, what happened was that although we had effected in some cases the raising of capital which might not otherwise have come, generally speaking we were incurring very serious loss to the State by means of these branch line companies. We had first of all to meet losses in case the net revenue did not reach the required amount for interest, but a further difficulty was that they were mostly built under contract with the main lines whereby the main line had to work them at a very low percentage of the gross earnings, which, with the rise of prices and rise of cost generally in recent years, has meant a steady loss to the main line concerns working the branch lines. Most of them are worked by the main lines, the trunk lines. So that we had to stand a double loss which was not perhaps a loss to the community, because it went into the shareholders' pockets, but it did not seem to us to be a sound financial thing from the point of view of the State.

2392. It was certainly a very complicated arrangement. Then, is it the case that you have relaxed in some measure the strictness of your rules about the construction, on the technical side, of branch and feeder lines?—Well, that perhaps is rather too wide a way of stating it; what we have done is to make a classification of the different classes of lines that may be constructed; we have, for instance, the standard A line which is to be built up to the standard of an important trunk line. Within that standard we have fixed the weight of rails, the standard of bridges, and the weight on the axle loads of rolling stock and locomotives, all scientifically co-ordinated together. Then we have standard B which includes lines suitable for branch lines; there we have a lower weight of rail, a lower standard for bridges and the facilities at stations and so on, they are all on the reduced scale. Standard C is for light railways with a minimum of equipment at stations, light rails and light bridge standards. Then we get down to standard D which includes all other kinds of feeder lines, narrow gauge lines and road rails, all built to a very low standard indeed. With these standards laid down now we are enabled first of all to assess the probable traffic which is going to be carried over the projected line, and then fix the standard to which it is to be built in such a way that we hope to obtain proper financial return on the outlay. In connection with that re-classification, we have made certain relaxations in connection with the axle loads of rolling stock which may be carried on certain sections of rails, but beyond that we have not relaxed standards to any great extent. It has enabled us to consider lines where the expected traffic is very low, and to fix a standard which will conform with the financial outlay which would be remunerative under those circumstances. Have I made myself clear?

2393. Perfectly clear. I understand that Provincial Governments or District Boards who may desire to see constructed tramways or railway lines are in a position to come to you and say: Build this line and we will guarantee the necessary funds to provide interest and amortisation?—Yes.

2394. But you in your turn, though you are at liberty to accept such proposals, are not bound to accept them?—The procedure is as follows: the Local Governments have been asked to send to the different railway administrations every year by a certain date their requirements in the matter of railway communications. In some cases that forms the basis of a consultation or a conference between the railway administration and the Local Governments. In other cases the proposals are practically accepted as a basis of the programme of work. Then within that programme of requirements of the Local Government the railway administration sends up to us its programme for construction for the following year. Actually we are working on a 5-year programme which is revised from year to year in accordance as far as we possibly can with the requirements of the Local Government. The

programme is on the assumption that the projects asked for by the Local Governments will be investigated by the railway. The investigation takes place, and if it is found that we cannot build a remunerative railway as required by the Local Government, we work out for them what guarantee, as we call it, we should require from Local Government or local body, and they are then informed that if they put up this guarantee we will carry on construction. That is the procedure we are working on. Where (a rather improbable event) we have found that it would be an unremunerative line and we do not wish for some reason to take up the matter under a guarantee, we should have no objection to the railway being built by the district authority; but we have a certain amount of confidence that the position will not arise, that we shall always be in a position to meet the requirements of the local authority or Local Government.

2395. Then I take it that eventually the only factor which would persuade you to turn down a Provincial or District Board's scheme for which you had an adequate guarantee, would be that such scheme would in fact short-circuit existing lines?—It might be a case of short-circuiting or it might be a case of affecting the traffic or financial returns on lines which we had already built. Of course, we have to remember that the State has 675 crores invested, and we owe a certain amount of duty to the general taxpayer that his interests are not going to be seriously affected by local propositions. But, as I say, none of those cases have actually arisen yet and we do not expect any such cases.

2396. At the same time it is not maintained, I take it, that in a country such as India it is right or necessary to wait until there is either an active vocal demand locally or the prospect of immediate financial return before a branch line is constructed? Is it not a first and essential stage in development in many cases?—We have taken rather a long view of that and in our estimates of the financial return of projects which we have under investigation we are generally satisfied if we find that the necessary return on capital is going to be produced within 5 or 6 years; we are quite willing to take a certain amount of risk on that.

2397. Do you feel very bold when you take a risk of 5 or 6 years in a country of this sort?—There are some railways which of course have not paid their way for considerably more than 5 or 6 years. The Assam-Bengal Railway made its first surplus profits over its interest last year after being in existence for 26 or 27 years; it is now beginning to pay its way, but the State took a very big risk in that way; we have been paying the interest on that railway for many years.

2398. So that the railway in question took a very progressive view when they constructed the line?—I think so. The existence of railway reserves, which we are now building up under the system of railway finance, we hope, will enable us to take risks of that kind. We do not think those cases of railways which are required by local authorities, and which would be unremunerative, will be very many in the future.

2399. The capacity to build up these reserves for future construction has of course only been possible since the railway finance was separated from the general revenue?—Yes, there were no reserves before.

2400. *Dr. Hyder:* You have got on these railways, you said just now, these class rates. Besides these class rates you have got those scheduled rates and station to station rates. I ask you whether you carry agricultural stuff at these class rates or at these reduced rates?—I should have explained when I said that the local railway administrations have complete power to quote rates within the maxima and minima, that the procedure which they generally adopt is to quote rates either by what are called scheduled rates or station to station rates; I do not know that I need explain to this Commission how they are worked; but generally speaking the schedules are either on a flat rate of so many pies per maund per mile or at a telescopic rate. Station to station rates are lump sum charges which are quoted as between two stations but still remain between the maxima and minima prescribed.

2401. You carry the bulk of agricultural produce at these reduced rates?—Yes, that is so.

2402. The Acworth Committee mentioned something about block rates and I wonder if that evil still exists?—The Acworth Committee investigated the matter very fully and I do not think they were able to find any basis for the general complaint about block rates as far as I remember.

2403. Coming to a small matter perhaps from your point of view but which may be very important from another point of view, suppose we had a scheme like this; that we selected one or two farmers in each tahsil in every district in a Province and sent them in the vacation when the boys are not attending their agricultural colleges to an agricultural college for a course of training with the object of letting them see how things are done at an agricultural college, would you be prepared to carry these farmers free or carry them at concession rates?—That is a matter we might consider. I understand there is a concession at present for students going to agricultural colleges.

2404. I was not thinking of students: I know they get concessions, but I was thinking of these cultivators?—Would you not call them students?

2405. From that point of view yes, they would be students?—We should not inquire too closely into their origin or whether they were capable of assimilating the course given in these colleges.

2406. I pass on to another matter. What would your attitude be towards the development of motor transport? Would you look upon it with the eye of a friend or with a hostile eye?—That is a practical question before us in a great many places in India now. Where motor transport acts as feeders to the railways we welcome it; where it comes into competition with the railways we shall do our best with God's help to fight it.

2407. Do you not think that even where they act as competitors they are possible agencies for stimulating traffic and travel? Even though they might at first appear to you are rivals, they might act as stimulators of potential railway traffic?—Speaking very broadly, we should look with favour on anything which encourages the movement of goods and passengers within the country. That is the sort of general policy we have. Anything which will encourage people to move about and to move goods more easily, we would encourage to the best of our ability; but I think we are quite right where definite active competition comes in, to try and meet it either by reducing our rates or by introducing better service or by such means as motor coaches or some kind of self-propelled coaches running on the rails, I think it is perfectly legitimate for us to meet competition of that sort. Where we can we are trying to enter into arrangements with people who are working motor transport as feeders, trying to enter into direct traffic arrangements with them to effect some kind of through booking. It is not always easy because this motor transport is at present rather in a nascent stage, very largely in the hands of small owners who are working for an immediate profit and have very little capital behind them and no particular stability. We have had that matter under consideration recently and have no doubt it will become more important in certain localities. There are some places where we have competition in the nature of short-circuiting, where we cannot hope to compete and where we do not expect to be able to cut them out; but wherever there is parallelling, that is to say, motor transport running on roads parallel to the railways, where we can, our method of competition will be to give a better service to the public than the local people with their motor transport can give. Where we can do so we shall get the business. But it is not an active policy with us to kill any kind of motor transport that may be existing.

2408. I was going to ask you whether you think the railway administration pay sufficient attention to this business of finding out whether their rates show elasticity so that your revenue may increase. You will know from your experience whether the rates are rigid over a long period of time or whether they show sufficient elasticity?—Each railway administration has its own organisation for dealing with rates and my impression is, from what I know of it, that they do actively follow up any cases where rates are found

to be restricting the traffic; they look upon it as the primary business of the railway to secure the maximum amount of traffic and they have complete flexibility in arranging their rates to suit any particular local conditions.

2409. So that in your view sufficient attention is paid to the development of traffic on the part of these administrations?—I would not like to say that the system is as perfect as it can be, and I should like, if I was speaking to railway administrations and not to this Commission, to ask them to pursue their efforts in this respect; but I do think there is an honest attempt to make the rates in such a way as to produce the maximum amount of traffic.

2410. It is alleged that since the introduction of this divisional scheme your rates officer at the headquarters does not know what quantities of stuff are sent to what destinations every day; that is to say, he is not in possession of statistical facts; is that so?—I do not think that is the case; there has been no change in that respect. In fact the Divisional Superintendent who is the authority now practically on the spot is in complete touch with all statistics relating to the movement of traffic over his division.

2411. But the rates man at the headquarters attached to the Agent does not know what quantities of stuff are sent from each station and to what destination?—He can if he wants to, because he has got all the statistics in the office. All the statistics are handled at headquarters; they are produced primarily in the divisions and then collated and collected at headquarters and they are available to the branches in the head office so that he has complete information; in fact under our new system of statistics we have very much more complete information available of movement as between stations than we ever had before. With the introduction of our compiling machines it is possible to produce now in a very short period of time complete and accurate figures of all commodities moving between different stations. It is only a question of punching a certain number of cards, putting them through the machine and getting a tabulated statement of all commodities like cotton, wheat or seeds, as between one station and another anywhere on the railway.

2412. I was wondering whether I could put any question to the witness about grain elevators?

The Chairman: Certainly.

2413. *Dr. Hyder:* Coming to this question of grain elevators, am I right in saying that these grain elevators would be cheap in the cost of handling but dear in the cost of storage?—Our memorandum on wheat elevators contains, I think, the sum total of our present knowledge on the subject. I really would not like to commit myself to any expression of opinion about their utility. We have put one of our officers, an expert officer, on special duty in order to study the whole subject in the Punjab and the neighbouring Provinces and he has been at work for the last two months. We hope very shortly to have a complete record on the subject which will be placed before the Royal Commission. At the present moment I am not conversant with the subject and I would not like to express an opinion.

2414. It is mentioned here that you are going into the subject. I was going to ask you a general question so as to find out whether these really would serve a very useful purpose in India. At present the arrangement, I think, is this, that when grain leaves the hands of the cultivator, it goes into a number of other hands. If we have an elevator company, though it will replace all these small traders, so far as it affects the welfare of the cultivator, one sort of agency will be replaced by another. Would that be so?—I should imagine that the logic of your question could not be controverted, but I would not like to endorse all your assumptions.

(The Chairman then said that it occurred to him that as Sir Clement Hindley had said that the whole matter was under investigation and had promised to send them a report and as the Commission would have to ask Sir Clement Hindley to appear before them at a later stage, the question of grain elevators might be reserved for the present.)

2415. *Sir Thomas Middleton:* Since 1890 I find that the mileage on Indian Railways has increased from about 15,000 to about 38,000 or 39,000, that is to

say, about 150 per cent or about 4·3 per cent per annum. The question I wanted to put you is whether that increase has been approximately uniform or whether there have been periods?—I am sorry I have not brought with me the diagram which would explain this matter. Would there be time for me to send for this?

The Chairman: Yes. (*The witness sent for the diagram from his office.*)

The Witness: It is an interesting diagram. Of course there have been periods when there has been a great stimulus given to railway construction. Lord Curzon's Viceroyalty was one of the periods when the construction was more rapidly extended.

2416. *Sir Thomas Middleton:* I drew a straight line between the two points and I asked myself what were the fluctuations in this period; I find that while the average increase is about 4·3 per cent, your programme for the next five years which is 6,000 miles of construction means a very great acceleration over the 35-year average?—I hope so. The maximum we ever got to before as a result of Lord Curzon's activity was 700 or 800 miles per annum.

2417. Even if you only carry out 5,000 miles, you will reach a thousand miles per annum?—Roughly speaking, yes.

2418. So that, a definite acceleration in construction is contemplated?—Yes.

2419. I assume that the five-year programme is as far as you have gone at present, or has a further programme been contemplated?—We have really a larger programme than that under consideration, but the programme which I have mentioned of 6,000 miles is one which we have definitely laid down for investigation and probable construction during the next five years. If that is carried through, at the end of that time, we shall have approximately 3,000 miles under construction. Assuming that the railway takes 3 years, generally it takes between 2 and 3 years, to construct, you can take it quite safely that we have at present about 9,000 miles of projected lines under consideration. As we work in five-year periods I have mentioned 6,000 as the amount which we hope to produce during the next five years. That covers 150 different projects. Of course, there always has to be a period of one year in investigation; that is, survey and investigation generally.

2420. Am I right in assuming that in these 6,000 miles there would be a greater proportion of metre gauge than there has been in the construction of the past 30 years?—Not necessarily metre gauge.

2421. Less than broad gauge?—We build now a species of broad gauge light railway which will carry the main line stock but on lighter rails and lighter bridges. A good part of these will be lines of that type. We do not adopt the metre gauge as feeder to the broad gauge but the 2 ft. 6 in. gauge is an appropriate feeder line to the broad gauge. That is to say, if the traffic does not warrant an additional broad gauge, the next step is a feeder line of the 2 ft. 6 in. gauge.

2422. You were questioned some minutes ago on the subject of motor lorries, and the competition of motor lorries. Do any of the Indian railways use motor lorries extensively for feeder purposes? In Great Britain, for example, one of our railways, at a very early period began to use motor transport, for feeder purposes. I was wondering whether any of the Indian railways has adopted this policy?—For passenger traffic we have not actually adopted that yet. I believe the Nizam's Railway, which is to some extent independent of our control, is contemplating regular feeder service, in some parts of the Nizam's territory, of motor busses. For delivering and collecting parcels in the big towns we have used motor lorries, and in some cases we have entered into arrangements with contractors to carry the stuff by motor lorry.

2423. I was thinking of rural areas where there may be highways which are not parallel to the railway. I wish to know whether in any part of India the motor lorry has been used?—So far, we have left that to private enterprise. We have an open mind on the subject.

The Chairman: My colleague Sir Ganga Ram is absent to-day. He has asked me to put one or two questions to you, which I think I had better read out from the typescript which he has provided me with.

2424. "What is the present railway freight of moving grain and oil-seeds to Calcutta, taking the starting point as Lyallpur? Give distances from Lyallpur to Ambala, Delhi, Cawnpore, Benares, Lucknow, Patna and Calcutta, and compare the same with the freights from Lyallpur to Karachi. The object of my asking this question is with reference to the complaint received from the traders of the United Provinces, that the *inter-provincial* freights are much higher than the rates to seaports, and therefore, when it does not pay a zamindar to export wheat, the higher *inter-provincial* rates prevent him from getting good prices if he sends his produce to Calcutta, wheat and oil-seeds chiefly?"—I do not know whether you want these figures. We can hand them in. On the general question I would like to refer to the investigation which was made on this particular subject by the Acworth Committee. They went into the question thoroughly and in paragraphs 150 and 151 of their report they answer the complaints in this way. May I read from that report? They said:

"Unquestionably, low exceptional rates exist for traffic to and from ports, especially the great ports of Calcutta and Bombay. But exceptional rates such as these exist in every country, and are there justified on the ordinary grounds, not only of the economy of handling goods in large volume, but also of competition between railway systems serving the same distributing or consuming area. In one respect, at least, the Indian railways have refrained from following the accepted railway practice in other countries. It is usual in most countries to concede for export traffic through a seaport, rates which are not available to that seaport for local traffic; and *vice versa*, in countries which adopt a Free Trade policy, to fix lower rates for the carriage inwards of goods imported through a port than for goods produced locally at the port town. This practice is not, so far as we have been able to ascertain, followed in India. Bombay receives from up-country large quantities of raw cotton, part of which is worked up on the spot and part exported. Similarly, Bombay distributes to up-country points large quantities of cotton cloth, part of it locally manufactured and part imported. The raw cotton rates down to Bombay port and to Bombay town are the same, and so are the manufactured cotton rates upwards. The same principle, we understand, is applied elsewhere, in the case, for instance, of the great Calcutta jute trade."

The Acworth Committee investigated the matter very closely and that was their opinion. We have not changed our policy since then.

Sir Ganga Ram, I take it, is concerned with the principle and not the illustration that he gives, I think we will assume that he does not require the detailed information asked for.

2425. "The Railway Company being a chief carrier of the public, and its interest being to earn as much as possible and to stimulate trade, is it not possible to give a little latitude in reducing the rates and giving the power to the local District Traffic Superintendents, in case of wheat and oil-seeds?"—I have explained the general provision of fixing rates. It is quite obvious, I think, that they must be fixed with regard to the railway administration as a whole and not locally. It would be quite impossible to give a local official the power to vary rates to suit the particular conditions of trade in his district. There are many obvious objections to that and I think it must be ruled out as an impracticable suggestion.

2426. "The borrow pits on both sides of the railway produce mosquitoes and cause malaria in the country. Do you not think that a system can be devised to put water-courses properly designed on the extreme limits of the railway into which the borrow pits might be drained and these outlets might

culminate here and there into suitable sumps on which zamindars of adjoining lands may be allowed to put *Jhallars* to take the water on to their fields or pumps in the way?"—Borrow pits, especially in Sir Ganga Ram's country are dry for a longer period than they are wet. They do hold a certain amount of water during the rains, but so does the whole countryside as Mr. Calvert will probably know better than I, though the water is not usually available for much in the way of irrigation. One of the difficulties which I think Sir Ganga Ram has overlooked is that when we dig borrow pits for the construction of a railway, we are very careful to leave *bandhs* or dykes between them, because in many cases the railway is working along the drainage of the country, and if the borrow pits get connected up and there is a free flow of water between them you will very likely cause a river alongside the railway which will cause very serious damage to the embankment. Therefore we are very particular to isolate these borrow pits. Any such system as he suggests of a canal connecting them with the outside, in some cases would be a serious danger to the railway. Actually the water of course is used by the cultivator fairly freely. There is hardly anywhere, where water lies beyond the wet season where you do not find these people making some arrangement to tip the water on to their fields. I do not think there is any restriction or charge in regard to that.

2427. "The zamindars' great complaints are that they do not get moving facilities from the end of the district to the district courts to attend court work. Therefore is it not possible to introduce charabancs holding about 40 or 50 passengers and to move to and fro and carry passengers who pay Inter class fare?"—This gives me an opportunity of explaining that this particular business of attending to the local requirements of passengers is a matter to which we are giving great consideration at the present time. On many small branch lines running perhaps between outlying towns and a court town we have found by investigation recently that the train services are not entirely suitable. Most of the railway administrations are taking up that matter and in many cases they are introducing self-propelled motor coaches which can work with more flexibility to suit the local requirements of the people. We are paying particular attention to this desire to get to the courts by introducing additional train services where necessary.

2428. "I find that Indian Railways do not give any concession on the class rates charged on the transport of sugarcane, hemp, vegetables and tobacco. Would it not be desirable to give concessions on these agricultural crops also?"—On sugarcane several railways do give concessions. They are shown on page 59 of our memorandum,* and other crops are shown on different pages. On pages 44 to 47 you have concessions on hemp; on page 63, concessions on vegetables; on pages 54 to 57, concessions on onions and potatoes, while on page 62 there are concessions on tobacco.

2429. "You give some concession on *ghi* for owners' risk rates; why do you not give concession railway risk also for this commodity? Have you got any special reason for this?"—I understand that there are both owners' risk and railway rates quoted for *ghi*. Of course the rates are naturally lower where the owner takes the risk than where the railway takes the risk.

2430. "On the Bombay, Baroda and Central India and Great Indian Peninsula Railways you charge actually higher rates than class rates fixed for cotton and on Assam-Bengal and Eastern Bengal Railways charge high rates than class rates on jute: why is that so? You charge six pies less on cotton on the North Western Railway when it is exported to Karachi and on East Indian Railway when it is transported to Calcutta. Does not this mean that you give greater facilities to exporters of cotton than to the cotton mill-owners in the country?"—This difference on different railways, of course, is a matter which has grown up under their powers to fix rates for themselves to suit their business. Originally each railway had its own separate classification and when a general classification was adopted it was found that particular railways had higher classifications, for example, on commodities such as cotton and jute, on which they were principally dependent for their traffic, while

*Not printed. For reference, see page 310.

other railways had lower classifications because they were not appreciably interested in that particular traffic. Instead of raising these lower classifications, after carefully considering each case to see whether the rate was restrictive or not, it was decided to allow the railways with higher classifications to retain them rather than to raise the classification generally. I might explain here that where a railway depends very largely for its earnings on a particular commodity it would be simply throwing away money to lower the classification there, whereas the lower classification on some other railway was probably best suited to the particular local conditions. We should have lost revenue on the railways where the commodity was an important factor.

2431. *Dr. Hyder*: Is not the mill industry concentrated at certain particular points, so that the rates for cotton are the same when it is exported as when it is consumed in the local mills?—That is so in Bombay. Rates are the same in both cases.

2432. *The Chairman*: The next question is: "I find that you give no concession in freights on the transport of fresh fruits on the North Western Railway and East Indian Railway. May I know what are the reasons for this?"—The East Indian Railway do quote special rates for fruit in the form of special station to station rates. They are shown on page 34 of our memorandum.

2433. "I find that except on the Great Indian Peninsula Railway, no concessions are given on the carriage of agricultural implements and agricultural machinery; may I know what is the reason for this?"—Page 19 of our memorandum shows the concession given in the form of station to station rates on several railways. It was not possible to put into our memorandum all the special rates, because it would have been too voluminous.

2434. May I ask on my own behalf whether it is the case that these preferential rates do exist on all railways?—I would not like to say all of them, but on a good many of them there are special rates for agricultural implements and machinery.

2435. Sir Ganga Ram's next question is: "In your memorandum you tell us that it would be better if grain is stored in elevators. Do you know what proportion of the exportable grain is exported within the first three months of the harvest? If almost the whole of the exportable grain is exported within the first three months, then do you require elevators to any great extent?" As Sir Ganga Ram's representative on the occasion I shall allow myself to be persuaded by what I said as Chairman a moment or two ago, and ask you to defer your answer?—May I just make a short answer. Sir Ganga Ram very kindly gave us a copy of these questions and I should like to say a word on the next six questions, including the one you have just read. Sir Ganga Ram has unfortunately read the memorandum by Messrs. Govan Brothers Limited as a production of the Railway Board, so that in any case I would not be able to reply because the questions refer to a memorandum which we have not prepared ourselves.

2436. *Sir Henry Lawrence*: You told us you have in view an extension of some six thousand miles of railway in the next few years. Can you tell us whether the majority of this new construction is for agricultural purposes or commercial or strategic? Can you divide it up at all?—I can rule out the strategic straight away. We have only a very small construction on the frontier in the Zhob Valley in Baluchistan. Apart from that all these extensions are of a commercial nature, and I think I may say that practically all of them will serve agricultural districts.

2437. Are they primarily for minerals (coal, manganese and the like) or do they open up agricultural areas?—A certain number of the lines, perhaps about 300 or 400 miles, are for the coal fields. The line which we are building from the Central Provinces, from Raipur to Vizianagram, will carry a certain amount of manganese traffic, but it will be very much more an agricultural line. Apart from that I may say all these lines are to serve agricultural districts.

2438. Then you have certain areas served by metre gauge and certain by broad gauge. Are these self-contained or is there any policy to make metre

gauge connected over very large areas?—We are trying to confine metre gauge development as much as possible within metre gauge areas. The metre gauge, of course, has proved itself to be very valuable in certain parts of the country; for instance, in Burma, where you have a combination of plains and hills sections. There the metre gauge is particularly suitable. And similarly in the south of India, where these lines run continually into the hills, the metre gauge is not at all unsuitable. Other parts of the country where the metre gauge has been found suitable are those where the population is thin and there is very little traffic, such as Rajputana. Generally speaking, we do not wish to extend the metre gauge section beyond its natural limits of that kind.

2439. Ordinarily there would be a break of gauge before you get produce down to a port?—We want to avoid breaks of gauges as much as possible.

2440. Would you have a metre gauge railway running down into harbours like Karachi, Bombay or Calcutta?—I hope we shall never have the metre gauge running into Karachi, Bombay or Calcutta. Chittagong, of course, is a natural metre gauge port. The only port about which I am doubtful whether we shall be able to avoid the double gauge is Cochin. Apart from that we have single gauges in all the ports except Madras.

2441. Your extension of railways, say in Sind will be on the metre gauge system and there will have to be a break of gauge to get the stuff on the broad gauge and thus to the ports?—I do not think we are expecting to build much metre gauge in Sind. We shall have either broad gauge or the 2'—6", which is the natural feeder to a broad gauge line. As far as I can remember we do not intend to build any more metre gauge in Sind.

2442. To turn to another point, you told us that your officers are now in close touch with delays in regard to the clearing of wagons through the introduction of a system of commercial traffic officers and telephones. Since when has this system been introduced? Is it of long standing?—We have had commercial traffic officers for a great many years as a part of the old Traffic Department. The system of telephone train control was introduced in 1916 when I think the first one was put down, and it has been extended fairly rapidly over most of the trunk systems.

2443. Then there is considerable hope that the complaints, which were rife in former years, of delay and difficulties caused by local officers are now very much more under control than formerly?—I think that is so. We installed the train-control system primarily with the object of facilitating the movement of trains; that is to say, the movements of trains were reported to headquarters and recorded on a diagram throughout the 24 hours. We have subsequently found many extended uses of this, one being the getting of complete information from stations about consignments ready for despatch and the distribution of wagons to those stations.

2444. Then you said there had been a great improvement in regard to pilfering. You mentioned the period 1921-25. Can you give us the figures roughly?—I am afraid I have not got the figures here, but I can supply them to the Commission.

2445. The actual amount of compensation paid by Railways is very much less than it was?—I cannot give you any exact figure, but there has been an enormous reduction. We were paying out over a crore of rupees in compensation for claims in one year. We have got that down to something very much smaller than that.

2446. And that also represents the decrease in pilfering?—We hope so. In fact, it must be so, because if a man's goods are pilfered, he puts in a claim.

2447. You gave us the personnel of the Advisory Committees. I did not catch whether on those committees there is any representation of the Department of Agriculture?—As far as I know there is none, but it rests with the Local Government to nominate a representative if they wish to.

2448. And would you welcome the nomination of officers specially interested in agriculture?—I think so, subject to the general consideration that these

committees if they are very large become useless. Their numbers have to be limited to some extent. It is quite impossible to work with a large committee.

2449. Have you any difficulty with regard to the octroi arrangements of cities? Do they cause any delay in the movement of produce from the villages into the big towns?—As far as I know there are no serious complaints about that, but I am afraid my knowledge does not extend in great detail to these localities. Octroi duties have been very largely got rid of in some of the Provinces at any rate and replaced by terminal taxes which are collected with the railway freights, and in those cases, of course, there is no greater delay in getting delivery than there is in the case of ordinary goods anywhere else.

2450. From the point of view of avoiding delay, do you regard terminal taxes as more satisfactory than octroi?—From that point of view I should say so. From our point of view we look upon them as encroachment on our revenue.

2451. For the benefit of the agriculturist, probably it is a more satisfactory system?—I should say so, from what I remember of the old octroi administration when I was in the districts myself.

2452. *The Raja of Parlakimedi*: Are seasonal special trains run in different areas to expedite export of agricultural products?—Special trains would be run where the need arose in order to clear traffic offering, but it is difficult to answer that question in general terms.

2453. Are any concession rates given if there is any necessity?—I do not think rates are varied to suit special occasions of that sort.

2454. Is there any concession shown for transport of material to build private lines on trunk lines?—What do you mean by private lines?

2455. Private-owned lines?—I do not recall that there are any cases of private lines being built.

2456. I am building one, that is Parlakimedi estate is taking up one?—Are you getting any concession?

2457. I am in correspondence. Is there anything on record to show that such concessions are given?—I am afraid I cannot answer that straight off. I shall have to make investigations. But it is always open to anyone to ask for a concession.

2458. It is a feeder line to the trunk east coast line?—I am afraid I cannot answer. I will find out, if you like, what has been done in the past. When one railway is building a feeder or a branch line it gets a lower rate for its materials carried over the railways over which it has to bring its materials. That is what we know as foreign railway material rates, that is to say, the East Indian Railway would give concession to the Great Indian Peninsula Railway for carrying railway materials.

2459. Is it a fact that the special curing system adopted in Dehra Dun for inferior varieties of timber has been successful in making them durable like any other first class wood?—I understand that the Imperial Research Institute at Dehra Dun has been making experiments for some years past on the treatment of timber. We are in close touch with those experiments.

2460. Those cured sleepers have not been tried on any line?—They are being tried on every railway, as far as I know, under very careful supervision by the forest officers of Dehra Dun.

2461. And you have no information whether they last as well as first class wood?—*Deodar* or *sal* sleeper lasts from 12 to 15 years and until you have had a treated sleeper on the line for that period you would not be in a position to say whether it would last as long as the other. But we have had very satisfactory results so far and we hope we shall find some of these varieties of timber very useful indeed for sleepers. We have our own sleeper-treating plant installed, we have had it now for two or three years at Dilwan. We are treating three lakhs of sleepers annually of various forest woods. We hope to put in another sleeper-treating plant in Assam where there is possi-

bility of getting suitable timber and wherever we can we shall adopt that method.

2462. In India what sleepers are more durable: iron or wood?—The most durable sleepers are *deodar*, *sal* and *teak*.

2463. Are they more durable than iron?—Steel sleepers last twice or three times as long as wooden sleepers. The average life of a steel or cast iron sleeper is something like 35 years as compared with the 12 or 15 years of wooden sleepers.

2464. Are any concessions shown to private individuals to put up sheds for storing their own goods on railway land?—I do not think so. We do not encourage the use of railway land for that purpose. Railway land is, of course, acquired definitely for railway purposes under the Land Acquisition Act and it would not be in accordance with the underlying principle of that Act to acquire land and then give it to private individuals.

2465. It saves the railway putting up larger sheds for storing purposes?—We should run the risk of being charged under section 42 of the Railway Act relating to undue preference in a case like that.

2466. *Sir James MacKenna*: In undeveloped tracts like Burma or Assam where roads are few, would you regard the expansion of a railway as more important than the construction of roads from the point of view of agricultural development?—I think the primary necessity is for the construction of railways in many districts in Burma, but they will not attain their full use until the Government of Burma sets about making roads.

2467. You think that roads should precede railways?—As a matter of actual fact, railways are preceding roads.

2468. I know they are; that is the point of my question?—I should like to see some more feeder roads in Burma.

2469. Feeder roads rather than roads parallel to the railway, I suppose?—Of course, there are people who prefer to travel by motor when they are going long distances and I have no doubt they will get their way in the matter of parallel roads. We are building 1,300 miles of railway in Burma. I have not seen very many hundred miles of road projected in Burma yet.

2470. *Professor Gangulee*: From the trend of your evidence, do I gather that you are satisfied that the cost of distributed services is reasonable in this country?—Of course we should like to see the possibility of lower rates, but having regard to our financial obligations, the amount of capital that has been invested and so on, I think that we are not unreasonable in our rates at present.

2471. Taking into consideration the fact that the margin of cultivation in India is comparatively low?—I do not understand what is meant by the margin of cultivation.

2472. Let me put it this way. The cost of producing wheat in this country per acre is lower than in other countries. Taking into consideration the cost of production and the margin of cultivation, *i.e.*, taking into consideration the general situation of agriculture as a whole, I want to know whether the rates bear any disproportion or proportion to that. Do you not think that the cost of transport is out of proportion to the price the producer receives?—I am afraid I have not studied the question from that point of view. It may be so. I do not know whether it is so or not.

2473. You said that railway companies are anxious to serve small growers. Do you not think that the traffic rates on small consignments are too high, say on consignments of 5 or 10 seers of fruit?—All these rates, you must remember, are based on the cost of the services rendered, and it is naturally more expensive to handle small consignments than large. They require more care and watching, identification and so on.

2474. Therefore the small grower is compelled to consign his produce to large dealers. He cannot sell direct; there is no chance of his selling things direct to the consumer or to the retailer in view of the fact that your charges

on small consignments are higher?—I do not see why that follows. There is no bar, as far as I can see, to his selling anywhere he can.

2475. If under the existing system the rates on small consignments are too high, then he is compelled to ask for the help of intermediaries?—Are you referring to grain and seeds?

2476. I refer to small consignments of vegetables or fruits, or things of that sort?—You have got to separate these things. If it is for grain and seeds the rate per weight is the same for small consignments and big ones. There are special rates quoted for small consignments of vegetables. Vegetables will always go in small consignments, I presume. They go at half the usual parcel rates on some railways.

2477. You do not think that the present rate is really a hindrance to the direct sale of small consignments of things like vegetables and fruit from the producer to the retailer direct?—I do not think so. If the distance between the producer and the consumer is so great that they cannot really afford to pay transit, the trade cannot go on. There is no doubt about that. But there is a limit below which we cannot quote rates for the carriage of the stuff.

2478. You do not make any distinction between the rates for produce in bulk and the rates on small consignments?—Not for grain and seeds and things like that.

2479. *The Chairman:* You have truck rates, I suppose?—Not for grain and seeds. The charge is on the actual weight.

2480. But for fruit, for instance, you would have a truck rate?—I think fruit is nearly always sent as parcels at the rates applicable to parcels. Some railways charge half the usual parcels rate for it.

2481. May we have an exact statement in the matter?—It is in the memorandum. I must admit that it is rather difficult to find one's way about the memorandum. It is all there but if you wish it to be supplemented, we can do so.

2482. *Professor Gangulee:* You do not think that the existing rates lead to the multiplication of intermediaries?—I cannot think that railway rates have any connection with that at all.

2483. You do not think that these rates compel small growers to stick to the existing chain of intermediaries?—I have no doubt the existing chain of intermediaries has a very large influence over them, with which we have nothing to do. The main fact is that we consider these rates to be the very lowest possible that could be charged. There may be cases where the rates might be reduced to some extent, but what has got to be remembered is that somebody has got to pay for the cost of transport, either the producer or the consumer, and the cost of transport, we believe, we have got down, if not to the absolutely lowest limit, at any rate to a very low figure indeed.

2484. In the event of depression in the price of agricultural produce, do you make any reduction in rates?—I do not think so. Our rates, as I have said, are based very largely on the cost of handling.

2485. Irrespective of the trend of prices?—Wherever we find that our rates are restricting traffic, the matter is investigated and if possible an adjustment is made. But there is no machinery for definitely connecting railway rates with prices.

2486. I was rather interested in your note on fruit traffic. Have you any suggestion for enforcing better methods of packing fruits and vegetables?—Of course the best pressure, I suppose, will be the economic pressure. If a man does not pack his goods well they do not get through and he does not sell them. If someone interested in the matter, perhaps the Agricultural Department, would take up the subject of better packing, the railways would be very pleased indeed and the traffic would increase.

2487. It is also to your interest that the packing should be standardised and done well?—Undoubtedly. We do our best to impress that upon consignees and we hope to do a certain amount of publicity in that direction.

with our travelling cinemas, about which we have told you. One of the things we shall probably take up there will be pictures showing how fruit should be packed and how it should not be packed.

2488. And the resultant wastage due to bad packing?—Yes. That would be very useful.

2489. Are you doing anything in that direction now?—I cannot assert that a film is being actually prepared for it. Certainly it is one of the things we have in mind. There are a good many subjects which we have got to tackle first.

2490. *The Chairman*: May we take it that you would encourage the use of returnable empties by free transit back to the consignor whenever possible; you have in some cases allowed that already?—We do quote a rate for returned empties, I believe, but it is not used to any great extent. Most packing which is used in this country is of a very perishable nature. It does not find its way back.

2491. You would welcome any improvement?—We should welcome any improvement that could be made.

2492. *Professor Gangulee*: Is there any scope for the standardisation of packing in this country?—Yes, I think there is. That is a subject that might very well be taken up by the Agricultural Department, I think.

2493. And you would co-operate with the Agricultural Department in the matter?—Certainly. A certain amount of work has been done in that direction.

2494. The difficulty I suppose lies in the fact that the ordinary grower is not organised. There is no organisation on the part of the growers to bring pressure on you in these matters?—I do not know about pressure being brought to bear on us. If they had an organisation it would be easier to influence them in the direction of better packing. It is not primarily a railway concern. We carry what is handed to us.

2495. Would you encourage co-operative marketing, and the co-operative movement for this purpose?—I know very little about the co-operative movement and co-operative marketing, but I think it would be an excellent thing. That is entirely my own private opinion.

2496. I am rather anxious to know what would be the attitude of the railway companies towards organisations for co-operative marketing?—I am afraid I should have to ask for some explanation of what co-operative marketing means, before I can give an answer to that question. We are anxious to encourage every form of traffic. We would only be too glad to do anything to encourage the marketing of agricultural produce.

2497. It would be to the interest of the railway companies to encourage co-operative marketing because then the produce can be collected in bulk, and bulk transport is much more convenient to the railway companies than small consignments?—I would rather hesitate to commit myself to a direct answer to your question, because I do not quite know what you mean by co-operative marketing. I would not like to bless an unknown scheme. Anything which would increase and encourage traffic we are ready to assist.

2498. Co-operative marketing means the handling of produce in bulk?—What kind of traffic?

2499. Say fruit?—How can you handle fruit in bulk?

2500. Supposing in different distributing centres we had co-operative organisations. Now you deal with an individual. When we have the co-operative marketing organisation, you will be dealing with that?—It is a matter of indifference to us who the consignee is; whether it is A or B, as it is the stuff does come in bulk. In the mango season we carry 30 or 40 wagon loads a day from Bihar to Calcutta. From Quetta we carry 25 to 30 wagon loads of fruit daily. That is handling the stuff in bulk.

2501. That is what you mean by bulk handling?—Yes. It is a matter of complete indifference to us whether there is one consignee or fifty. We should

prefer, of course, to deal with one rather than fifty, but it is a matter for local organisation rather than for us.

2502. It would greatly facilitate your transactions to have dealings with a co-operative organisation rather than so many individuals?—Probably it would.

2503. In reply to the Chairman, you remarked that railway authorities could not undertake warehouse arrangements. Do you not think that the concentration of produce is advantageous from the point of view of transport facilities?—I did not say that we would not undertake warehousing. We do already to some extent. We have to be careful that we do not trench on private enterprise in that direction, however.

2504. *The Chairman:* If I may interrupt for one moment, I think Professor Gangulee was thinking about an organisation amongst consignors and I think you were dealing with consignees?—I thought possibly there would have to be some organisation of consignees too. We do not want to turn our stations into a fruit market. I rather thought he assumed that there would be an organisation at each end. We should be only too glad to see that kind of thing in being. I quite agree with that.

2505. *Professor Gangulee:* That is what I wanted to get at. With regard to the wastage of fresh fruits and vegetables, is there any scope for cold storage dépôts at market points?—We have given the Commission a memorandum on the subject of cold storage, which contains most of my knowledge. I think there is undoubtedly scope for it, but I think it is a question really of arranging a chain of cold storage dépôts at suitable places throughout the country before it could be a profitable railway undertaking.

2506. Would you leave it in the hands of private enterprise?—At present we feel that private enterprise ought to have a chance of dealing with it, if it is going to. If a chain of cold storage dépôts was once established, we should immediately come forward with the necessary refrigerator vans to carry the stuff between them.

2507. Are refrigerator or insulated vans successful now?—We have insulated vans so arranged that they are kept at a very low temperature. As far as I know they are successful. We get the so-called “Quetta Fruit” which really comes from Afghanistan and it is carried in them quite conveniently and safely to Calcutta. In that case I believe they are successful.

2508. Referring to the question of roads, do you agree that the existing condition of roads feeding railway centres in India is a handicap to the development of better transport facilities?—In some Provinces, it is a distinct handicap. We should like to see better and more feeder roads.

2509. Then you are of the opinion that extensive road improvement would effect substantial savings in transport?—I do not know. I am doubtful on that point, but the extension of roads and feeder roads in the country would undoubtedly improve general conditions of transport and increase our business. One of the great difficulties at the present time is (and railway engineers and officers generally have a great deal of knowledge about it) the deplorable state of many of the roads maintained, or rather not maintained, by the local authorities. There has been a progressive deterioration of roads maintained by local authorities practically all over the country in the last few years, and certainly in the last ten years, in my view.

2510. The Government of India, I understand, is considering the question of forming a Central Road Board?—I have no direct knowledge of that myself.

2511. Railway companies could not take any initiative in this work of the development of road improvement?—There we come up against an important constitutional question. The construction and maintenance of roads under the present constitution is a provincial subject on which the Central Government is prohibited from expending any funds.

2512. *Mr. Calvert:* On that question of roads, I understand you are prepared to consider the construction of railways even though you calculate that they will not pay, provided that the Local Government will guarantee to you the difference?—Yes,

2513. So that really Local Governments have now the option of either bearing the whole burden of constructing new roads or giving you a guarantee for any loss of revenue?—That is so.

2514. I had a series of questions to ask you and it may be that you would prefer to give a written note rather than answer verbally?—You very kindly sent me a copy of that list last night, but I am afraid I have mislaid it. If you will read them out, I will do my best to answer.

2515. The first question is this: In other countries such as Denmark, Germany and Belgium, railways are used as a means of subsidising agriculture through the freight rates. What is the effect of the separation of railway finance upon such proposals to utilise the railway rates to off-set the loss to agriculture arising from the policy of protection? Will the Railway Board be able to accept such proposals for lower rates if the Central or Provincial Governments credit them with the difference?—I do not think that the separation of railway finance has had any very definite effect upon this important question. The railways have always in theory been considered self-supporting. Individual railway administrations have had to meet their own interest charges and make their own profits, and I think there has always been a feeling, if not a definite policy, that railway rates should not be used as a means of effecting subsidies to industries or to agriculture; so that that answers the first part of your question. No essential change has been caused by separation. For instance, it has been the custom for many years past, in times of famine, for special rates to be quoted for fodder, I think half rates. Anyhow, a special rate is quoted by the railway, the difference between that and the normal rate being made good by the Local Government who asked for the concession. As a general principle, of course, I think I would rather hesitate to commit the Railway Board or the Government to the proposal as it stands, because in this are involved much larger questions of finance than I am able to deal with. The whole basis of a protection policy where bounties are given or duties are imposed is a matter which is really outside my Province. For that reason it would be difficult for me to say that the Government would be prepared to use railway rates as a means of off-setting the results of protection.

2516. A recent committee in England has recommended that Government should take the responsibility of a reduction of rates, not less than 25 per cent in existing rates, for agricultural produce. You will find that in the Second Interim Report of the Agricultural Committee in 1923, paragraph 24. In Germany there are special preferential rates on manures, and fodder is carried 50 per cent below the regular rates. The point is, am I right in thinking that you can work in any such recommendation without breaking your policy, of which you are strongly in favour, of separate railway finance?—From the point of view of constituting an accounting machinery for an operation of that sort, there would be no difficulty. As regards the larger implications of the policy, I would hesitate to give an opinion at the moment. Where you have got a policy of protection, which in effect may cause higher prices to be paid by local people for implements or something of that sort, I could not say straight off whether the effect of that policy would be nullified if they were subsidised to meet the difference. I am not sufficient of an economist to say what would happen in a case of that sort. So far as railways are concerned, if you look upon us as a commercial concern, I think we should have no objection to a proposal of that sort, but the implications of it and the results of it I have not really thought out.

2517. With regard to the question of concessions for fodder, I believe you debit Local Governments with the difference between your normal rate and the special concession rate?—That is so.

2518. So that if, for instance, later on a proposal were made that similar concessions should be extended to pure seed and manures and agricultural implements, a similar adjustment could be made?—There is no accounting difficulty, certainly.

2519. So that we should not be debarred by the separation of railway finance?—Subject to higher financial considerations, we see no objection.

2520. The third question I wish to put to you concerns your general policy towards light rural railways, rural tramways and ropeways. Would you prefer to put in a note on that?—I have explained this morning, I think, the policy with regard to feeder lines and branch lines, and that applies equally to these methods of transport. We are already building what you might call a light railway or tramway in the Punjab between Shahdara and Narhwal.

2521. You would call it a tramway?—There is very little difference between that and a tramway. I might give a rough description of our lowest conception of a light railway: it is a light railway carrying daylight traffic only with practically no facilities for stations, the train stopping at suitable intervals to pick up passengers or goods, with booking arrangements on the train. That is our lowest conception of a light railway and that corresponds closely to a rural tramway. We are quite prepared to build those.

2522. Is there in India anything which would militate against the construction of these light tramways by, say, local bodies?—Generally speaking, we prefer to build them ourselves.

2523. It is rather trenching on your preserves?—There is a good deal of benevolence about it. The general feeling is that we can build them better and work them cheaper than local bodies can do. It is in the interests of the country generally that we should build them. I think that is the general feeling. I might say that the Punjab Communications Board have definitely accepted that.

We did, yes.

2524. Then I put a question down on a complaint handed in to us. It is a very general complaint that the railway freight is high and acts as a great hindrance to marketing produce. I gather that is not the case. You are carrying at the lowest possible rate?—I think, generally speaking, we are carrying at the lowest possible rate. In cases where a specific complaint like that is made, we investigate it and see whether we can come down with the object of helping marketing.

2525. Then the sixth question was: What is the policy as regards the encouragement of local fairs and shows, ploughing competitions, etc.? Are railways willing to grant concessions to competitors, their bullocks, etc.?—I think nearly all railway administrations make special concessions when there is any local show on. This is a matter which we leave to the railway administrations to effect. But generally speaking, I think these concessions are nearly always given where the thing is brought to notice. I understand that on most railways there are permanently established concessions for recognised fairs and exhibitions.

2526. The seventh question is more contentious: To what extent does the zone system prevent the opening of cross lines connecting points on different systems?—May I ask a question in return? What do you mean by the zone system?

2527. There is considerable difficulty, for instance, in having that line linking up the Delhi-Umbala-Kalka Railway with a point in the southern Punjab?—Of course it is but natural to allot certain spheres of influence to certain railway administrations, and when a question of short-circuiting comes up, it is not really so much a question of the rival interests of the two concerns as the fact that the short-circuiting may effect very wide-spread changes in the rating systems on other adjoining railways and affect the whole rating structure. For that reason there has been generally in the past, I think, some reluctance to make these short-circuiting lines; but the Government of India's policy now is that wherever a line can be built to improve local communications such considerations as short-circuiting should not be too seriously taken into account. We have naturally to think of the interests of the people who have put money in these existing railways. There is the State, the largest shareholder, with its 675 crores, which has got to consider its own interests. But we take a rather broader view, and are at the present moment considering the construction of several lines which would under the past regime have been considered short-circuiting lines. We take the view that if you can

shorten distances, more goods will travel and in the long run the main lines will benefit by the increased traffic.

2528. We may take it, then, that the agricultural development of a tract is not being hampered in any way by considerations of zones?—I think that is so except in a very few instances. I think there are perhaps three or four cases where lines might have been constructed some years ago which have not yet been built, but we are hoping to build them.

2529. In regard to the question of the protection of goods on railway platforms from weather conditions, I understand from your answer to the Chairman that you are now doing all you can to protect goods from weather conditions?—I think the railways have generally taken a good deal of trouble about that. Where the amount of traffic makes it necessary, I think goods-sheds have been erected at the stations. Where there are small quantities of traffic, other special measures of protection are taken, such as the provision of tarpaulins. But if there is any serious bulk of traffic, goods-sheds are erected. There may be instances of districts which have rapidly developed in the agricultural way where the railway facilities are not up to requirements. These we are taking in hand as fast as we can, as fast as funds permit.

2530. You have told Sir Henry Lawrence that octrois are being replaced by a terminal tax, and I understand that you are collecting this terminal tax on behalf of local bodies. Some local bodies are inclined to propose terminal export taxes, a very different thing. Have you any policy on that?—I do not think we have got any policy in regard to that, because I do not think any such case has arisen yet. I do not think we have got any export terminal taxes so far, at any rate I have not heard of them before. I may be wrong.

2531. On the last committee there were several very dangerous proposals for levying taxes on agricultural produce and on salt from districts?—We do not like these terminal taxes in any shape or form because we consider them theoretically at any rate an encroachment on our margin of charge; that is to say, if a man can afford to pay his railway freight *plus* the terminal tax, he can equally afford to pay a higher railway rate.

2532. *Professor Gangulee*: Is not there a terminal tax on jute?—That is a Local Government affair. We do not collect that. That is excise or customs.

2533. *Dr. Hyder*: Was not there a flagrant case at Nagina?—Yes. It is a very dangerous power to put in the hands of a local body, because apart from anything else it means imposing a tax on transport; which, I think, is a thing everybody reprobates.

2534. *Mr. Calvert*: Any Indian import tax is a tax on consumption?—It is a tax on transport, at any rate.

2535. The proposals now coming up for an export tax from municipal areas are very serious?—They are just as bad as the other, and perhaps worse. I think economically they are unsound, because one thing we have tried to resist throughout the history of railways has been a direct tax on transport.

2536. I presume we may take it that the railway authorities are making the maximum effort to deal with pilfering?—I hope so. To the best of our ability we are endeavouring to stop it.

2537. I think it is only fair to the railway authorities that I should give you an opportunity of commenting on a passage placed before us. It is to the effect that "complaints relate principally to the shortage of wagons. Many traders say the number of vehicles in use on the railways is too small to carry the normal traffic of the country and that consignments of produce are frequently detained for days or even weeks at roadside stations for want of wagons?"—What is the date of that complaint?

Mr. Calvert: 1926.

2538. *Dr. Hyder*: Is that in the United Provinces report?*

*Not published: Report on Agriculture in the United Provinces (1926) prepared for the use of the commission.

Mr. Calvert: Yes.

2539. *The Chairman:* May I say that although this memorandum has been provided by the United Provinces Government they are not responsible for the remarks contained in it.

The Witness: As a matter of history, up to a few years ago that complaint would have had a great deal of foundation, but for the last 24 months we have had a surplus of wagons on all the railways of India. For the last three or four months we have had 30,000 wagons standing idle and these we have had great difficulty in finding room for. Standing on the rails they occupy something like 130 miles of track in various parts of the country.

2540. *Professor Gangulee:* Is that the condition in the harvesting season? —There are various harvests which come at different times. There are cotton, wheat and oil-seeds, and what we call the "peak" of the traffic occurs at different times, and under the system which we have now of pooling wagons, all wagons are available for all railways and we have been able to meet the maximum peak and still have wagons in hand. During one of the heaviest peaks of traffic we had still three or four thousand wagons in hand not used. In the early part of this year, we had something like 10,000 wagons. Year by year we are getting our wagons moving more rapidly. We have been able to effect great improvement in the speed of trains and the time taken in marshalling, shunting, loading and unloading, and that is having its effect, and we now have, instead of a shortage, a surplus of wagons, all over the country, so I do not think there can be any strength in a complaint of a shortage of wagons for carrying the produce of the country at the present time, nor do I think there is likely to be any complaint for a good many years to come.

2541. I thought the opportunity should be given to you to deal with that? —I am much obliged to you for the opportunity of making that statement, because the old cry of the shortage of wagons used to get on our nerves, and I think we have been able to get over that difficulty altogether. I do not think there is any part of India where there is a shortage of wagons now. May I add that under the system of pooling all wagons we have a central office established at Allahabad under a Director of Wagon Interchange, who receives daily reports from all the railways regarding the state of the traffic on their lines, and he has complete power to adjust the balance of wagons on all the railways according to traffic requirements. So that from day to day when there is heavy traffic, he disposes of the surplus wagons by sending them to one railway or another to meet local requirements. But in the last year his business has been mainly to find room or stable wagons, and this is becoming a somewhat serious difficulty.

A similar complaint has been put before us by one official from Bengal, who says:—

"The producers of jute in Rampur and Jalpaiguri often suffer greatly because the railways cannot supply sufficient transport facilities at the proper time. They divert their wagons to places where there is competition with the steamer companies for goods traffic."

The jute traffic is peculiar and a thing worth study. It is extremely complicated. The requirements for wagons for bringing jute down to Calcutta or Chittagong vary from day to day in accordance with the state of the market and the continual day to day business which goes on of trying to anticipate what the market is going to be in order to bring down large consignments of jute or hold them up up-country, so that the railway is put to great difficulty in supplying wagons to suit the actual needs of the moment and there may be occasions when the demand is greater than the supply. But I think, on the whole, there is no great difficulty in getting the jute crop through to time. We have the same difficulty in Calcutta on arrival. The jute is brought down and put into railway goods-sheds and in many cases the market may have changed a point or two and the man does not find it convenient to take delivery and he leaves the jute there for his full free time, which I think is 48 hours. In some cases the goods-sheds get full and it is essential to stop the traffic coming down, and then some restriction has to be placed on the book-

ings of jute up-country until the sheds are cleared. The only device we have is to shorten the free time and charge wharfage on the jute in the sheds. That action has to be taken sometimes and there are complaints of the want of facilities at the goods-sheds. The jute traffic is in a state of surge throughout. Either people are holding up taking deliveries or they are holding up bookings, or they are wanting to rush the stuff down and take delivery promptly, and it is extremely difficult for the railways to meet all these requirements and naturally complaints are made. Difficulties must arise at times but on the whole I think the facilities and the wagons are sufficient to get the crop down within reasonable time.

2542. You consider these difficulties chiefly due to the work of speculators?—I should imagine speculation plays some small part in this matter, but I should not like to charge the jute trade with being speculators wholesale.

2543. *Mr. Calvert*: In a note on the rural prosperity of Burma the complaint is made of the high cost of marketing produce owing to insufficiency of railways. I understand that you are giving full consideration to that question?—We have a very large construction programme in Burma being undertaken by the Burma Railway Company and it is based on very close collaboration with the Local Government. The programme of construction there is endorsed by the Local Government and I think goes as far as we can afford to do at the present time. We shall be nearly doubling the mileage of railways in Burma. I quite agree that there is a need for further railway extension in Burma and I think we shall be able to meet that very largely in the future.

2544. We have had a certain amount of evidence before us about the shortage of fuel and grass. May I ask what you do with the fuel and grass on the railway embankments?—The grass is sold locally by the engineers in charge of the sections, generally by auction, I think. The practice varies all over the country, just as the grass does; so it is difficult to generalise, but the general principle is that the grass on a certain length of railway, so many miles, is sold by auction to the local people and they are allowed to cut it. We have great difficulties with people who want to graze it instead of cutting it, but generally speaking it is sold to the highest bidder.

2545. The fuel is sold locally too?—There is not much in the way of fuel. We have plantations in some places, and any firewood which may be available is no doubt sold in the same way.

2546. *The Chairman*: Have the railways as such considered building ropeways in mountain areas as feeders?—I do not think we have considered a definite proposal of that kind as a railway undertaking.

2547. In answer to my colleague, the Raja of Parlakimedi, I understood you to say that there can be no question of the railway companies selling a part of the land they acquire under statute for the construction by private persons of storage facilities. Is it the case that there have in fact been no such sales?—We have a system which I might mention in that connection of leasing or letting out land on a license for oil depôts at certain stations. The reason for that is that these oil depôts up-country are on the bulk system very largely and it is convenient to have the depôt close to the railway so that piping can be arranged. I should not like to say definitely that no such facilities have been given anywhere but it is no part of our policy to use railway land for the benefit of private people in that way.

2548. But if you yourselves are not inclined to undertake to provide increased storage and if corporations or private persons have difficulty in obtaining land sufficiently near your important railway junctions and stations to make storage useful, would it not be to the public advantage that such corporations or individuals should be able to lease land from you so as to give the public this service?—The difficulty is that we have generally got no land available. Most of the land, having been acquired for the purpose of constructing buildings and railways, is used to the full for that purpose, in the big towns especially. I think I am right in saying that if a local body wished to undertake that kind of work, it could secure the land under the

Land Acquisition Act. A *mandi* (a kind of local warehouse) has been built by many towns or local authorities in the Punjab, and I think they probably acquired the land under the Land Acquisition Act.

2549. *Mr. Calvert*: You are prohibited from selling to individuals land required for railway construction purposes?—Yes. We cannot sell land to private individuals; all we can do is to relinquish the land to the Government to do what it likes with.

2550. *Professor Gangulee*: You cannot lease out land?—We can under certain conditions.

2551. *The Raja of Parlakimedi*: It is only for the storage of oil you lease out land?—Generally speaking, at up-country stations we lease it out for oil storage, and in some places we lease accommodation for storing coal.

2552. Is not salt included?—I do not know if we lease out any land for storing salt. We do lease out some of our goods-shed accommodation in big cities, portions of it to particular firms, but that is in the ordinary course of business.

2553. *The Chairman*: A question on quite a different matter. I take it that railway companies are responsible for and carry out the disinfecting of wagons used for the carriage of livestock?—Yes.

2554. Is the occurrence of contagious disease notified to you?—I think the Local Governments and the local authorities would certainly do that. I do not know the exact procedure, but it must be the case. The local traffic officer would be notified by the local authority concerned with the outbreak.

2555. In the case of any restrictions in the matter of moving livestock from district to district and Province to Province, if such restrictions are in force, are you given early information about it?—I do not know the procedure exactly, but I am sure we are bound to obey any orders issued by Local Governments in the matter of restrictions.

2556. Now, a more general question which will make plain to you a matter, which I am sure is already clear to you, why as a Commission we are so closely concerned with freight rates. You would probably agree that a slight difference in freight charges which any concession might be likely to amount to would not mean much, if anything at all, when translated in terms of retail prices to consumers?—Yes.

2557. But you would probably also agree that measured over the whole volume of producers' output for the year, a slight difference in freight rates might be of very considerable advantage to the producer?—Yes.

2558. *Sir Henry Lawrence*: Can you give us in general terms some idea of how your general rates, both for passengers and goods, compare with the rates charged in other countries?—I am afraid I have not got the information here. I have got a note on that which, I could send to the Commission later.

2559. Generally speaking, are your railways run more cheaply than in other countries? Do you carry goods traffic at a cheaper rate than railways on the continent of Europe or in England?—Yes; I shall probably be up against Dr. Hyder and Professor Gangulee on this subject, I am afraid, because it is a question of what basis you take for the cost of living and standard of wages and so on; but I can give you just one or two figures which will show what they amount to. For instance, the average rate for carrying a ton of goods per mile last year was 6·21 pies, that is about half-a-penny.

2560. How does that compare with rates in other countries?—I am afraid I have not got the figures with me. I can put them in in the form of a note if you like. The average rate for carrying a passenger per mile was 3·47 pies. Translated into English money, the rate for goods works out to roughly 5 shillings per ton for every hundred miles on Indian railways; and the average passenger rate (we carry 600 million passengers annually) is 3·47 pies per mile. I think that in actual money, both these rates are cheaper than on any other railway in the world; and of course the cost of equipment and materials is practically the same or higher for Indian Railways than in the case of railways of other countries.

2561. *Professor Gangulee*: When you talk about the goods rate, do you speak about the rate at owners' risk or the rate at companies' risk?—I am giving the average amount we received for every ton of goods we carried on all railways in India.

2562. *Sir Thomas Middleton*: If the comparative figures are easily available it would be very interesting to get similar figures for Italy and for Great Britain?—I could give you some comparative figures; they were prepared for the Honourable Sir Charles Innes for his recent speech at the Indian Railway Conference Association and appeared in the papers. I will certainly send them in.

2563. *Dr. Hyder*: Have you any figures for Japanese railways?—Yes, I think so.

2564. *Mr. P. C. Sheridan*:* I think the Japanese are the next highest.

Dr. Hyder: Because that is an oriental country and conditions for comparison are easier.

Professor Gangulee: Not always.

(The witness withdrew.)

* He is a Member of the Railway Board and was present at the meeting.

APPENDIX A.

Statement showing the amount of claims paid on Class I Railways from 1920-21 to 1925-26.

(In thousands of Rupees.)

Name of Railway.	1920-21.	1921-22	1922-23.	1923-24.	1924-25.	1925-26.
Assam-Bengal .	13	15	23	17	17	22
Bengal and North-Western.	84	88	1,71	1,63	81	93
Bengal Nagpur .	2,01	2,64	1,99	2,64	2,02	80
Bombay, Baroda and Central India.	34,65	22,69	15,69	6,45	6,03	4,40
Burma . .	43	51	45	29	34	31
Eastern Bengal .	1,79	1,89	1,99	1,77	1,68	1,87
East Indian . .	24,92	31,78	57,99	42,73	30,61	11,73
Great Indian Peninsula.	25,42	28,11	19,68	16,17	6,64	3,41
Madras and Southern Mahratta.	2,59	2,89	2,21	1,54	86	91
Nizam's guaranteed State.	40	41	38	24	17	18
North Western .	17,83	23,40	16,90	4,73	6,84	3,90
Rohilkhund and Kumaon.	24	41	45	17	22	17
South Indian .	96	79	64	45	32	49
Jodhpur Bikaner .	29	41	97	12	16	8
TOTAL .	1,12,50	1,16,96	1,21,23	79,10	56,87	29,40

APPENDIX B.

Memorandum regarding Local Railway Advisory Committees.

I. *Title*.—The new bodies to be known on each line as “Railway Advisory Committee.”

II. *Constitution*.—A separate main committee to be constituted for each administration, the number of members being decided by circumstances subject to a maximum of 12. The Agent to be *ex-officio* Chairman. The remaining members to consist of—

- two Local Government members nominated by the Local Government in whose jurisdiction the headquarters of the railway in question is situated;
- three representatives of the Legislative Council of the Government in whose jurisdiction the headquarters of the railway in question is situated. These members should be selected to represent rural interests and the travelling public;
- one member from the local municipality or corporation at the railway headquarters;
- five members representing industries, commerce and trade.

The heads of departments of railways may be called in merely to advise on subjects under discussion which may affect their department and on which their technical expert advice would be useful to the committee.

The method of selection of the non-official members to be left largely to local discretion. The representatives of the Legislative Council need not necessarily be members of the Council. Members of the Central Advisory Council are not debarred from membership of Local Advisory Committees. The five members representing industries, commerce and trade would ordinarily be drawn from important local bodies representing predominant trade interests; the actual selection of such bodies should be made in consultation with the Local Government, and once the selection is made it should be left to them to nominate or elect their representatives. The tenure of office of the members to be left to the electing or nominating bodies to decide.

Agents will consider whether it is desirable to form separate branch local committees at large centres, and in case of doubt they may consult their main committee in this matter.

III. *Scope of duties*.—The functions of the committee to be purely advisory. The sort of subjects which might suitably be placed before the committees are:—

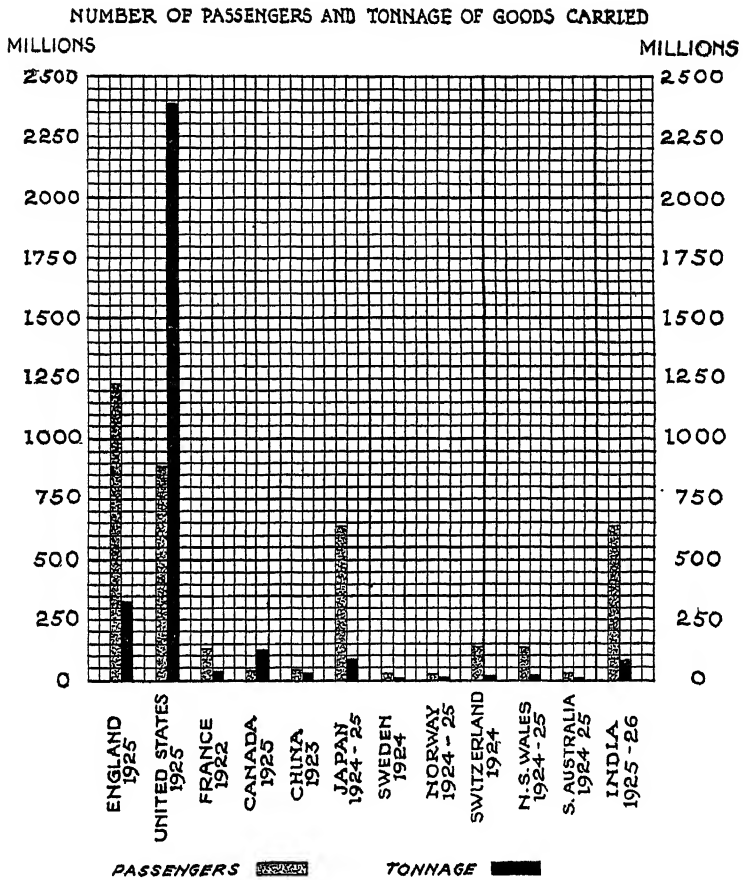
- (a) alterations in time-tables and passenger services;
- (b) alterations of rates and fares and changes of goods classifications;
- (c) proposals in regard to new projects and extensions;
- (d) proposals in regard to new rolling stock;
- (e) any matters affecting the general public interest or convenience.

Questions of personnel, discipline and appointments will not be brought before the committee; subject to this condition any member may suggest a subject for discussion, but the Agent may rule out any subject for reasons which should be explained at the first meeting after the ruling has been given.

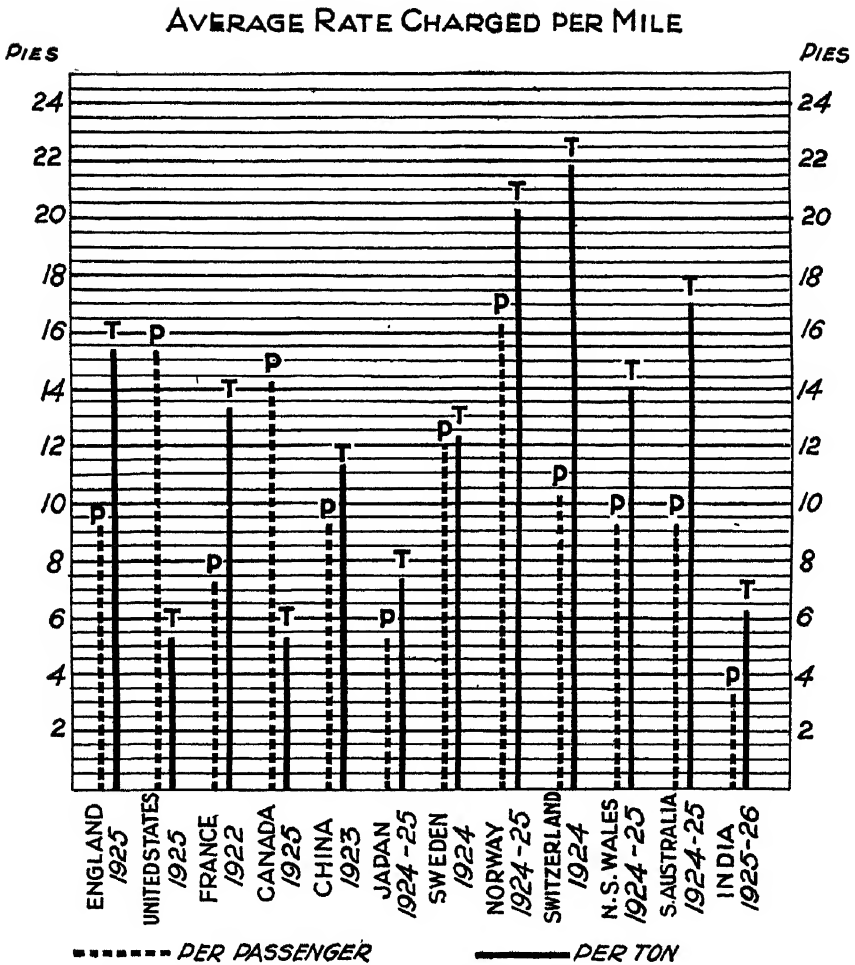
IV. *Remuneration*.—Non-railway members may be paid Rs. 32 for each meeting attended.

V. *Proceedings*.—The committee to meet once a month if there are matters to be discussed. A copy of the minutes of meetings to be furnished to each member and to the Railway Board. If in any case the Agent decides that he is unable to follow the advice given by the majority of the committee, he must bring the matter to the notice of the Railway Board in forwarding the minutes of the meeting for their perusal.

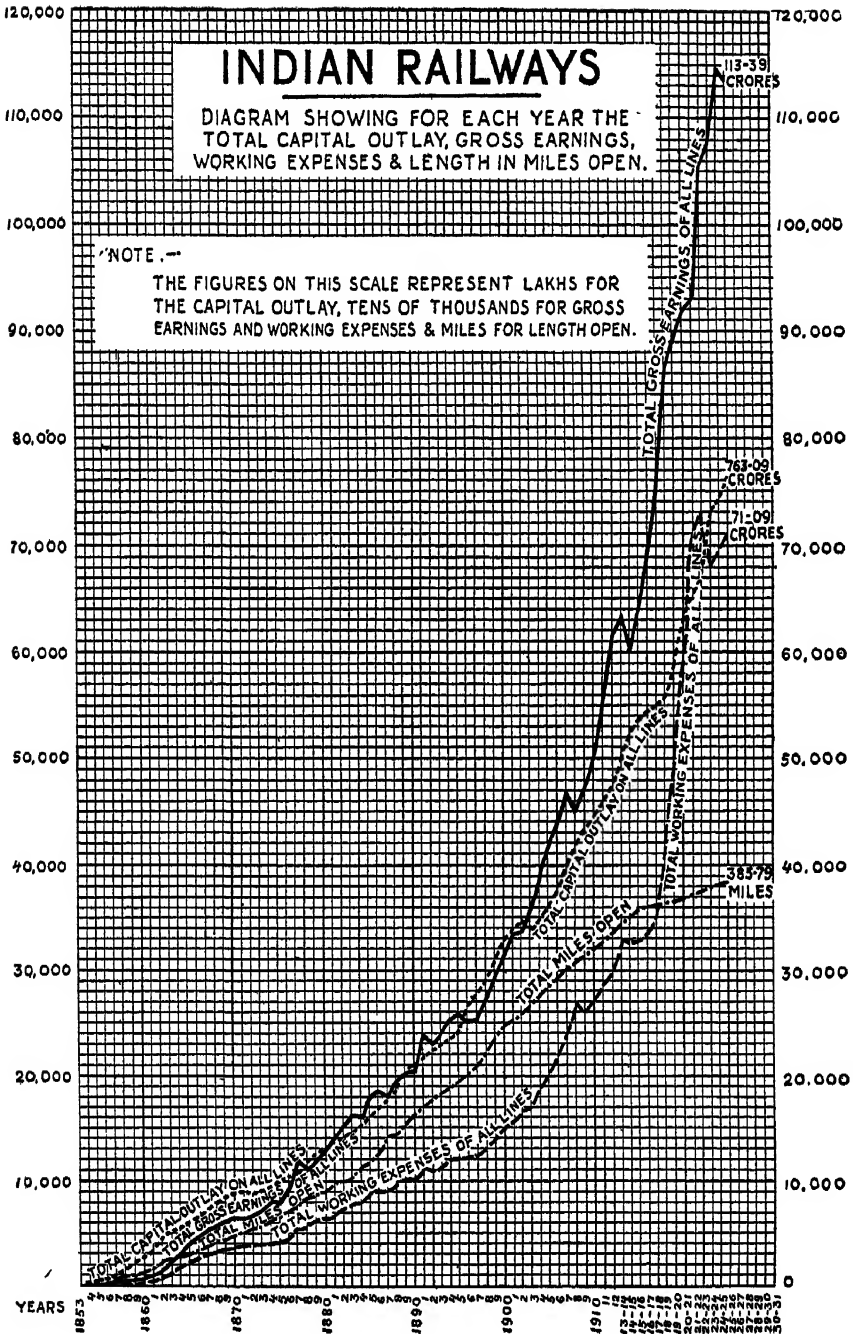
APPENDIX C.



APPENDIX D.



APPENDIX E.



Lieutenant-Colonel A. S. MARRIOTT, Director of Farms, Master General of Supplies Branch.

Memorandum on the work of the Military Farms in India.

1.—Military Dairy Farms.

Object of Dairies.—Military dairy farms in India have been established by Government since 1889, and for the purpose of providing a safe and reliable supply of pure milk, butter and cream to military hospitals and troops in cantonments, private enterprise having entirely failed to meet the requirements of the situation.

Prior to the institution of Government dairies, there was no branch of the dairy industry in India that was in any way organised. The supplies made to British troops may be said to have been in the hands of the Indian cow-keeper, who maintained a number of cows and buffaloes in a more or less half-starved condition, housed them in filthy houses, fed them mainly on garbage and milked them into vessels that were "cleansed" in the nearest puddle. There was no guarantee that the *gowala* or his animals were free from disease.

Present day conditions show no very marked improvement and the insanitary and very often filthy conditions under which milk is produced and retailed and butter manufactured in many of the so-called Indian dairies is well known, and in most Provinces there is no law fixing a standard of quality for milk and butter or enforcing the purity of dairy produce offered for public sale.

Danger of Basar Supplies or supplies from uncontrolled sources.—The Cattle-Breeding Committee appointed by the Bombay Government and consisting of five Indian gentlemen, one of whom was chairman of the committee, with two European officials, reported as late as 1923 in the following terms on the conditions of the dairy trade in India :—

"At present it is impossible for private persons to establish the opening of up-to-date scientific milk producing and selling owing to the want of regulation. The present unscrupulous milk producer is able to adulterate his milk in many ways. This is particularly noticeable in Poona, Bombay and Ahmedabad. A considerable supply of milk is exported to Bombay and other places from Anand. This milk contains boric acid and formalin, added as preservatives in such quantities as to be highly injurious.

"Scientific dairies are under supervision necessarily entailing expense. The produce, however, is superior; but in a country like India where cleanliness is at a discount such produce is unable to compete with a filthy and more cheaply manufactured article.

"Milk in India to-day is anything from 2 to 6 times dearer than in any other country in the world. This is due to the poor milk-producing qualities of the indigenous cattle. The evidence before the committee proves that the price of milk is rising rapidly every year. A number of enterprising people have started dairies but all, almost without exception, have failed, firstly, owing to the poor milk-producing qualities of the cattle; secondly, for want of protection by legislation, and thirdly, for want of encouragement by Government.

The committee whilst touring in Gujrat took the opportunity of visiting some of the so-called dairies in Ahmedabad where the bulk of the butter and other dairy produce is manufactured for the whole of India. The committee were surprised to find that this industry is carried out under the most filthy and dirty conditions imaginable. These so-called dairies are situated in the most insanitary by-lanes of the city. The butter produced under these conditions is sold all over India and a certain amount is exported (even to

Great Britain). It is a well-known fact that milk and its products are the best medium possible in which injurious bacteria and germs of typhoid, diphtheria, cholera, etc., thrive and in which they are carried and spread over the whole of India. It is essential for the public health that production on honest and scientific lines should be made a financial success, so that the public at large will get a safe and sure supply of milk and its several products."

The fact that these conditions are prevalent all over India justifies the continuance of the Military dairies.

Lack of technical advisers and experts.—The lack of experience was a great handicap to the pioneers of the Military dairies, who had no real idea of what a technical business dairying is or how much there was to learn about it. A start was made without even the advice of such experts as were available. The advice of an expert fully versed in the technicalities of dairying on a high European standard combined with a knowledge of Indian conditions was not available, for the simple reason that there was no person who possessed knowledge of both sets of conditions.

In 1906, 17 years after the opening of the first Government dairy in India, the services of a dairy expert were obtained from England (Mr. W. Smith, now Imperial Dairy Expert). The dairy expert himself would be the first to admit what an immense amount he had to learn as regards the modifications Indian conditions impose upon European methods, many of which could only be ascertained by repeated experiments, and the most careful observation. Dairy farming in India was a new industry and Government was paying for experience.

Organisation.—Under the original organisation farms were grouped in divisions in charge of a Farms officer who was required to administer both the grass and dairy farms of a division. The general organisation and administration of military grass and dairy farms in India was fully enquired into by Lt.-Col. T. H. Henderson, Military Accounts Department, and Mr. S. B. Fremantle, I.C.S., in 1910. The scope of enquiry included also the financial aspect of military farm operations and the consideration whether the maintenance of farms generally was justified by the results of their operations. The finding of the committee was favourable to the continuance of dairy farms.

The result of this committee's recommendations was the separation of the dairy from the grass farms branch of the Farms Department. As regards personnel, two administrative circles were established with two Assistant Directors of Dairy Farms. This organisation has continued and is still in vogue with the exception of the period April 1921 to March 1923, when a third circle was formed.

Distribution.—The distribution of dairy farms at present is :—

Northern Circle.

Peshawar—Cherat.
Rawalpindi and Murree.
Sialkot.
Lahore Cant.
Dalhousie.
Jullundur.
Ferozepore.
Ambala.
Simla Hills (Kasauli, Dagshai,
Subathu and Jutogh).
Quetta.
Bannu—with Razmak, D. I. Khan
and Manzai.

Southern Circle.

Lucknow.
Cawnpore.
Allahabad.
Agra.
Jubbulpore.
Mhow.
Deolali.
Kirkee.
Belgaum.
Aden.

Young stock farms at Jalloo—Sargodha—Malakwal—Gambar and Sitapur.

NOTE.—Under the recommendations of the Inchcape Committee, the farms at Karnal, Bangalore and Wellington together with the permanent establishments employed on these farms were transferred to the Civil Department from 1st July 1923.

Staff.—The British staff (present strength 24) were recruited from selected men of British Corps or Army Departments, and had to undergo training for two years, when, if successful in their examination, they were appointed on a year's probation. In 1912, the new entrants into the department took their discharge from the Army and became civilians. The option to do so was extended to existing incumbents. The Reform scheme for India has extended to the Military dairies and the scheme for Indianisation was sanctioned from 1st April 1922. This scheme allows for the replacement of Europeans by Indians in the managing personnel of the Military dairies in India—(sanctioned complement 132). Candidates for appointment have been plentiful, on the other hand resignations and discharges have been heavy. The duties of an Indian supervisor entail long and trying hours and experience has so far shown that men with high education and good connections are not altogether suited for the onerous and practical duties an Indian supervisor is called upon to perform. They show a tendency to play the rôle of superintendent rather than act as a practical manager.

Defects.—When the new organisation was imposed in 1912-13, the administrative officers were confronted with a very difficult task. Mistakes had to be remedied and defects made good. The extent to which dairying in India was to profit by the progress of western and temperate countries, and the modified methods to be adopted had to be learnt and many problems existed, peculiarly its own, that India alone could solve.

The main defects that existed were :—(i) Poor milking herds. (ii) Bad young stock. (iii) Insufficient and badly designed cattle sheds. (iv) Insufficient buildings of other descriptions. (v) Inadequate lands for grazing and cultivation.

Herds and Breeding Policy.—In regard to (i), the main factor of success or failure of any dairy from a financial point of view lies in the quality of the herd.

The poor milk yield of the country-bred cow is notorious. This is mostly due to the deterioration and the hard conditions of life of various breeds of cattle, which, under favourable conditions, are of high milking value. The climatic conditions of India entail, unless special provision is made, an entire lack of succulent fodder necessary for milking cattle during a long period in each year, the same conditions impose the absence of cheap fodder of any kind for the same periods. The cattle are owned by a class of people who lead a hand-to-mouth existence, men with no capital, and therefore when fodder is scarce and dear the cattle go short of food. The average Indian cow may be said to be sufficiently fed during, and for some time subsequent to, the monsoon, and to suffer in varying degrees from semi-starvation till the advent of the next monsoon. In these circumstances, Nature has, as a protective measure, imposed restrictions on the natural breeding proclivities of the animal which thus starts breeding later in life and subsequently breeds less often than would otherwise be the case, a reduced outturn of milk also places a lessened demand on the vitality of the animal. Where, in the case of the Indian owner, the cow costs practically nothing to keep, and what milk is produced is mostly gain, the conditions described above to some extent, to a very unsatisfactory extent perhaps, suit the circumstances of the country. When, however, dairying on the scale and standard of military dairies is attempted, the conditions impose a most severe handicap on financial success, so severe indeed that success is impossible unless they can be altered. The cow in the military dairies cannot be kept for nothing, the food bill is in fact the most important item on the expenditure side of the account. The disadvantage, therefore, of an animal that has to be kept an unusual time before she starts to breed, and that breeds subsequently at irregular intervals and gives a poor yield of milk, is obvious. There is but one remedy and that is for the military dairies to breed their own herds,

and by careful selection of bulls and cows, and by good feeding, to breed out the disadvantageous characteristics engendered by generations of starvation. This is the more necessary as the experience of recent years has proved beyond doubt that from one cause or another the milking breeds of the country are rapidly deteriorating, and it is becoming increasingly more difficult to purchase cattle that might be called good milkers judged even from the Indian standard. It is necessary to recognise that any improvement that is to be made to the herds of military dairies must come from within, and that such dairies must breed and rear the herds of the future. "Feed and Breed" must be the motto of every military dairy if success is to be gained. This policy has been inaugurated since the commencement of 1912-13 but there was little to work upon. Rinderpest had played havoc with the half-breds, and the numbers of these valuable milkers was also reduced on account of the unfortunate hiatus that took place in the importation of English bulls between 1908 and 1912. The dairy-bred country cattle, with notable exceptions in the case of one or two dairies, were little, if any, better than what could be purchased, a fact which was mainly due to the non-recognition of the importance of good feeding when young, and lastly there were few farm-bred bulls of any value from which to breed. The last item is perhaps the most important of all. The influence of a bull of a good milking strain on his progeny, besides being recognised throughout the world where dairying is carried on on scientific lines, has been most unmistakably shown by the use of English bulls with country-bred cows; the resulting half-bred heifers have yielded 100, 200 and sometimes 300 per cent. more milk than their dams. Had the necessity for breeding country bulls from selected stock been recognised from the start, the year 1912-13 would have found dairies with a stock of bulls infinitely better than anything that was to be purchased. When purchasing a bull in India it is seldom that there is more to go upon than the looks of the animal, there is no pedigree and so far as inherited milk-producing qualities are concerned appearances go for little or nothing, the real value of a dairy stud bull lies in the milk yields of his female ancestry.

At the present date it may be confidently stated that in the case of cows the best milkers in the herd are home-bred animals; the major proportion of which are half-bred animals. To wait for the improvement of the Indian cow to obtain a milch animal with a greater yield of milk, was recognised as a long, tedious and expensive process.

This has, however, been carried out at the Ferozepore farm which has maintained a pure country-bred herd of Montgomery (Sahiwal) cows and by selection and grading and careful breeding this herd is an example of what can be accomplished with knowledge and means and time at disposal. A number of pedigree bulls of this pure-bred Montgomery herd were auctioned at Ferozepore in 1922 and 1923 and though good prices were obtained, they were bought almost entirely for Government Institutions and farms. There is no real demand at present by the small farmer for pedigree cow bulls. He would appear to place greater importance on draught qualifications and to rely on the buffalo for milk. A short cut had to be resorted to and an improved animal was found by the introduction of bulls of European breeds of well established milking qualities. The result of crossing country-bred cows with these bulls has been most successful in the case of first cows or half-bred. The milk yields of these half-breds have shown marked increases and in several instances are comparable with cows of Western countries. The animals have retained their constitution and stamina and proved good doers.

The crossing process when extended to $\frac{3}{4}$ and $\frac{7}{8}$ European animals has not proved a success, the proportion of failures was large and the animals were generally wanting in constitution and possessed a smaller degree of immunity.

The importation of bulls commenced in 1907. The measure was regarded as an experiment only and very few were imported. At first it was considered that bulls imported from Australia would be more likely to withstand the Indian climate than bulls from the United Kingdom. The idea proved to be fallacious and the stock was distinctly inferior, price for price, to what was available in the home market upon which reliance is now entirely placed.

The bulls imported have been mostly Ayrshires, but recently British Friesians have been obtained. The above remarks in connection with the crossing of country cows with European bulls refer to the Ayrshire breed.

Indications have also seemed to show that the failure of further cross was due to two reasons, namely, the heavy hair of the European strains and the necessity in India of a dark pigmentation of the skin.

If exotic breeds with short hair and dark pigmentation were used, good results might be obtained. Such success as had been obtained was only where the exotic had dark skin and short hair. Holstein crosses $\frac{1}{2}$ and $\frac{3}{4}$ have given good results, but not equal to the first cross. The present policy is to maintain sufficient country cows of the best milking types to mate with imported bulls to produce the half-bred high milk-yielding cow, and to supplement the demands with buffaloes.

The buffalo continues to be indispensable to every large herd and though replacements can generally be more economically made by purchase in the open market, it has been found successful and profitable to breed and rear a number from selected dams, specially selected male calves being kept for stud purposes. The buffalo has peculiarities of its own that handicap it as a milch animal. When young it is delicate and more difficult to rear than the cow. The conditions of a large dairy herd seem more inimical to it than to the cow. It commences to breed later, the difference being approximately 12 months, and it subsequently breeds less regularly than the cow. It needs a larger ration and is therefore the more expensive animal to feed. The male calf of the buffalo, if not required for the stud, is of considerably less value than that of the cow. The buffalo has the advantage of yielding milk containing more butter fat than the cow, but as by far the greater quantity of butter sold by military dairies is obtained from military established creameries, which obtain milk for the purpose of butter making by purchase, this quality is to a considerable extent discounted.

The following table showing the classification by yields of cows for the years 1912-13 and 1924-25 is indicative of the improved yields obtained :—

	1912-13		1924-25.	
	Cows.	Buffaloes.	Cows.	Buffaloes.
Over 10,000 lbs. . . . .	...	...	1	...
9,000 to 10,000 „ . . . .	...	...	4	.
8,000 „ 9,000 „ . . . .	.	1	30	...
7,000 „ 8,000 „	5	2	35	...
6,000 „ 7,000 „	4	10	81	25
5,000 „ 6,000 „	19	15	158	95
4,000 „ 5,000 „	65	102	280	259
3,000 „ 4,000 „	248	276	375	386
2,000 „ 3,000 „	586	502	310	219
1,000 „ 2,000 „	708	549	140	76
Under 1,000 „	549	310	93	48
Total	2,184	1,767	1,507	1,108

Young Stock Farms.—The general inadequacy of lands for grazing and cultivation in cantonments rendered the rearing of young stock very expensive and to overcome this handicap young stock farms have been established at Gambar, Malakwal, Sargodha and Jalloo, and act the rôle of foster-mother to the parent farms, and by commercial farming maintain both dry and young stock, free of cost. Young stocks are transferred at about six months of age and kept until mature and when in calf they are drafted off to the parent farms to replace casualties. The dry stocks are kept until about to calve again.

Lands.—Another difficulty has been that of the provision of adequate areas of grazing and arable land, and as these dairies are intended for the use of troops, they have to be located in cantonments where troops are stationed, an excellent arrangement for the convenience and health of the Army, but in many instances a great disadvantage to the farms, and several have been established with insufficient land and at times inadequate water-supply. The area of lands held at present are :—

In cantonments 5,633 acres.

Outside cantonments 1,515 acres.

Area of Young Stock Farms 7,260 acres.

All milk issued as fresh milk (new milk) is produced from milch cattle which are the property of Government, housed, fed, watered and milked on Government premises by Government servants. The feeding and milking is always carried out in the presence and under the direct supervision of a specially trained staff.

Butter sold is made from pasteurised cream properly ripened and safe from a hygienic point of view. It is not for the most part made from milk of Government-owned cattle.

All employees of a Military dairy are protected from enteric, small-pox, etc., by inoculation and tested to ensure that none of them are carriers of the enteric group of diseases.

Sales of dairy produce and rates.—The trade of the dairies is restricted to the supply of produce to troops, Army departments and establishments; civilian non-military Government officials and their families may be supplied only when a surplus exists. Sales are made to Government hospitals, officers and their families, troops and their families exclusively, and it is significant that the price is beyond the means of the Indian soldier.

There are three sale rates for dairy produce :—

- (i) One rate for officers, Government institutions and the general public.
- (ii) One rate for British troops.
- (iii) A concessional rate for the families of British troops.

In practice every endeavour is being made to establish a flat rate for each farm, a special concessional rate for soldiers' families to continue. A copy of the latest sale rates is attached (Appendix).

Pasteurisation and cold storage.—Pasteurising plants have been installed chiefly for the purpose of pasteurising milk and cream bought from outside sources for the manufacture of butter. If specially requested by the medical authorities, milk for drinking purposes is pasteurised, but this adds considerably to the cost. This is, however, invariably carried out when milk is sent by rail or road, i.e., Kirkee to Bombay and Peshawar to the Khyber Pass outposts. For the better preservation of milk and cream it has been found necessary to establish cold stores at the larger dairies, i.e., Peshawar, Rawalpindi, Kirkee, Lucknow. The running of these plants which are very desirable in this country with high temperatures adds so considerably to the expense that their extension to and use on smaller farms is prohibitive.

Trade.—The quantities of dairy produce sold during 1924-25 compared with the three previous years and average sale rates were :—

Years.	MILK.		BUTTER.	
	Quantities.	Average sale rate per lb.	Quantities.	Average sale rate per lb.
	Tons.	Rs. A. P.	Tons.	Rs. A. P.
1921-22	5,910	0-3-10·4	509	1-11-8·5
1922-23	4,519	0-3-6·5	450	1-9-10·5
1923-24	3,839	0-3-4·2	343	1-9-8·4
1924-25	3,572	0-2-11·5	341	1-8-8·4

Finance and trading results.—A cost-accounting system of accounts is in vogue and audited locally.

The following accounts are prepared annually :—Trading Account, Capital Account, Profit and Loss Account, Balance Sheet (Government Account).

The consolidated balance sheet of the military dairies as at 31st March 1925 from 1st April 1912, shows a loss of Rs. 55,46,530 which includes Rs. 12,74,607 the amount written off and which represents the difference between the residuary capital value of the assets arrived at by the revaluation of the farms capital on 1st April 1925, and the closing balance on 31st March 1925. The Government account on 1st April 1925 was Rs. 24,22,443 bearing interest at 6·1 and 3·3 per cent. The revaluations were the outcome of the recommendations of the Inchcape Committee. Owing to the abnormal prices and purchases during the War, whereby farms were overburdened with capital which was not all incurred as a requirement of their ordinary activities, but rather to meet the capital demands of the late War, and with a view to restarting the farms with the capital actually required, the Government of India decided that the capital assets of each farm should be revalued and this was carried out with the above results.

These farms have, as a whole, since April 1925 worked at a profit, and this has been achieved partly by the relief enjoyed on the revaluation of capital assets and by drastic retrenchments and economies effected in all departments and centralised financial control.

The Government of India have approved of the proposal to open a departmental *pro forma* Reserve Fund account subsidiary to the accounts of the military dairy farms to meet losses in famine years and from other unforeseen causes and to prevent violent fluctuations in prices.

Sanction has also been accorded to the formation of a depreciation reserve fund.

Epizootic diseases.—It would be difficult to compute the heavy losses farms have suffered from cattle diseases in the past. Hæmorrhagic septicæmia and rinderpest have proved the most serious. Vaccines and serums supplied by the Research Institute, Muktesar, have given very satisfactory results and the immunisation against rinderpest by the so-called serum-simultaneous method has given very good results.

The following is a detail of specific diseases amongst dairy farm cattle during 1924-25.

1. Anthrax	1
2. Biliary fever	2
3. Contagious abortion	69
4. Foot and mouth diseases	681
5. Hæmorrhagic septicæmia	6
6. Jhone's disease	39
7. Rinderpest	113

Total strength of herds on 31st March 1925 :—

Adult stock	3,345
Young stocks	872
Calves	401

Piggery.—It was recognised over 25 years ago that pig-keeping, breeding, etc., was very backward in India. Following the example of Denmark, the establishment of piggeries as adjuncts to dairy farms was proposed. It was understood that success could not be attained until a very marked improvement had been made in the quality of the country pig.

A start was made at Allahabad and Lucknow, and the pigs experimented with were (1) the Berkshire (2) Large white (3) Mid-white (4) Small white (5) China—and all helped to improve the stock.

So long as large quantities of separated butter and milk were available for feeding and cheap grains obtainable, the results were profitable. The produce—fresh pork, sausages, bacon and pork pies—was greatly appreciated by the troops. Owing to a severe outbreak of swine fever in 1906, the pigs at Allahabad were slaughtered and this piggery was closed down.

A piggery was established at Karnal also in 1906 in conjunction with the Karnal creamery. The pigs were bred and reared at Karnal and sent to Ambala during the winter months to be slaughtered, and the produce manufactured and retailed.

Conditions have changed since the War and pig-keeping has not proved profitable and bacon can now be imported at approximately the same price as retailed by a military piggery.

There is no real market for pigs in India and large numbers cannot be disposed of without the expense of manufacturing bacon and pork products, and due to climatic conditions this can only be carried on for 7 to 8 months only. In consequence pig-keeping is not a paying proposition and has been discontinued.

2.—Military Grass Farms.

Grass Farms.—Up to about 40 years ago, the fodder supply of the Army in India was met by allotting grass-cutters to the various units, except in the Bombay Presidency and certain stations in Madras where it was obtained by contract. The grass-cutter system had many disadvantages, the principal being that it entailed heavy expenses in maintaining and moving about a large army of camp followers, who constantly got into conflict with the civil population through stealing grass off village or other lands. The grass brought in was often obtained from low lying swamps, and caused frequent cases of anthrax. Many of the grass-cutters were women and their presence in the cantonments largely increased the amount of venereal disease among the troops. The system, moreover, admitted of practically no variation of the feeds. A committee which was assembled to consider the forage question in 1887 made the following remarks :—“The condition of the country is now so entirely different to what it was when possibly the evils of the grass-cutter system were less felt, that, whether the matter be viewed as a measure of mere justice to the agricultural

classes, or a question effecting the dignity of the State, the necessity for providing land where grass may be obtained, or of paying for the right of cutting it in particular localities, must be accepted." In the Bombay Presidency it was the practice for the Forest Department to hand over such lands as were necessary to meet the fodder requirements of British and Indian mounted corps. The harvesting was done by contract, which for many years in succession was held by a Parsee family who adopted the patronymic of "Grasswala" and who, having the entire monopoly, amassed large fortunes. In the case of the Indian Cavalry, there was constant collusion between the Indian ranks and the contractors resulting in enormous claims for compensation.

As cultivation increased in the vicinity of cantonments the difficulty of obtaining grass-cutters became more and more acute, and in 1882 the late Sir Herbert Macpherson, when commanding at Allahabad, conceived the idea of utilising the spare lands in cantonments which up till then had either been lying waste and unremunerative, or had been let out to zamindars for the cultivation of high crops. The latter system necessitated the presence of large numbers of undesirables inside cantonment areas, and was objectionable on military and sanitary grounds. The result of this experiment was entirely successful from every point of view. The cantonment revenues were increased by the payment of moderate rentals, the bare and dusty plains were shown with grass thus conducing greatly to improved sanitation, a variety of fodders was introduced, and the cost of the production compared very favourably with that of the old methods. Government, therefore, decided in 1888 to extend the system in the late Punjab and Bengal Commands, and gradually nearly every cantonment in those areas had its own grass farm. Indian Cavalry regiments were also allotted lands either within or outside cantonments, which they were expected to harvest themselves, State aid being given when necessary. The operations of the military farms were confined to meeting the requirements of British mounted units to the extent the lands sufficed, the balance, the mobilisation reserves and the supplies to Government transport animals, being met by contract. One of the chief advantages of the new system was the enormous hold it gave Government over the contractors, as it was recognised that there was very little demand for properly made hay in India outside military requirements, and once the contractors got hold of all the available fodder areas, they could, in many stations, make their own terms. The farms were administered by the (then) Commissariat Department, an officer being appointed in each of the two Commands to supervise the operations. The local grass farms were worked by station committees with a regimental officer as Secretary.

This system continued for some years, but it was found that owing to the constant changes of officers and their want of technical knowledge the fullest value was not got out of the lands. It was therefore decided to train selected officers and subordinates at the parent farm at Allahabad, and in 1899 the control of the farms was taken away from the Supply and Transport Corps and placed under the Quartermaster-General in India and a Farming Department was formed.

Policy.—The policy of Military Grass Farms is :—(i) To provide fodder for all Government animals in cantonments, both camping and marching. (ii) To supply and maintain fodder for War reserves according to sanctioned scales. (iii) To accumulate gradually in good years when fodder is cheap and abundant, a reserve of hay up to a limit approved by Government.

The conditions at present prevailing in regard to fodder are still the same as they were twelve years ago and the reasons why it is still necessary that Government should continue the actual production of fodder are broadly :—

- (i) The production by Government of a portion of the fodder required by it enables it to maintain an effective control on the fodder markets of India and to obtain at cheap rates the fodder required by it to supplement farm produce.
- (ii) The farms produce the best classes of fodder and in many stations without a farm it would be impossible to obtain the hay requirements,

Administration.—The general administration of military grass farms by the Director of Farms at Army Headquarters, under the Master General of Supply in India.

Organisation.—The present organisation comprises 10 circles :—Peshawar, Rawalpindi, Lahore, Quetta, Meerut, Lucknow, Bannu, Jubbulpore, Poona, and Bangalore.

Total number of farms 43.

Staff.—Officers are recruited from the Indian Army and must have less than 10 years' service—(strength 19).

European subordinates are military men transferred from British Units—(strength 49).

Indian overseers are obtained from Indian Units or may be civilians specially recruited—(strength 100).

Lands and Cultivation.—Lands are held permanently and temporarily leased and are situated both in and out of cantonments.

The areas for 1924-25 were :—

Permanent.		Temporary leased lands.
Within cantonments.	Outside cantonments.	
29,610 acres.	99,669 acres.	112,783 acres.

The chief aim and object of the cultivation of grass farm lands is the production of green grass and hay. The cultivation of fodder crops is justified and economical in order to clear and clean land; and when canal irrigation is available, also to provide green fodder for units when green grass is not available, or is insufficient.

Outside these limits it is preferable to purchase direct from the cultivators.

The chief fodder crops cultivated are :—

Kharif season . . . Jowar, maize, Rhodes grass and Guinea grass.
Rabi season . . . Lucerne, oats, barley, shaftal and berseem.

Special success has attended the cultivation of *berseem* and five to six cuttings are frequently obtained giving an outturn of 20 tons of green fodder per acre.

Machinery and Implements.—*Steam Baling Presses* are used all over India for compressing fodder. The two types of plant in use are :—

Jessop's hydraulic press.

Howard's Dreadnought Continuous press.

The standard weight of a bale is 80 lbs. net.

Mowing machines are extensively used for cutting grass on lands level and suitable and to supplement cutting by hand. The types in use are Wallace's Thistle, and the Albion and Nerbuda mowers. One machine can deal with about 3 acres per diem.

The *Reaper* is also used for white straw crops and to expedite the harvest and will cut 5 acres in one day. Like the mowing machine they are subject to rough usage necessitating constant repairs. Allowing for depreciation, wages, repairs and lubricants they pay their way.

The reaper is not popular with the tenant, but it is recognised that their employment is necessary to supplement labour and that by cutting in time the loss of grain is minimised.

Threshing machines have been tried, but the imported type is not altogether suited to Indian conditions and although the grain is clean, the disadvantages are low daily outturn and clipped gram—the latter demands an allowance on the price and is unsuitable for seed, a serious handicap.

For cultivation the following implements are used :—

Barani land.

Sabul or Disc plough.

Rajah or Disc plough.

Disc harrow.

Roller or cultipacker.

Spring tine harrow.

Peg tooth or lever tooth harrow.

Seed drill.

Irrigated land.

Rajah—Victory—Ceres or Meston ploughs.

Country plough.

Spring tine harrow.

Peg or lever tooth harrow.

Plank (Sohaga).

Seed drill.

The mould board plough is used for the initial ploughing.

The Spring tine harrow is used for fallow land during the hot weather to break up clods and conserve moisture after showers of rain.

The Lever tooth harrow—breaks up the soil and leaves a fine seed bed—of modern implements this is the most popular.

Quantities of fodder dealt with and cost.—

Year.	Produce.		Cost per ton.
	Tons.	Cost.	Rs.
1921-22	1,01,812	33,49,131	32.9
1922-23	1,06,104	33,60,633	31.6
1923-24	1,03,957	32,59,225	31.16
1924-25	1,03,230	31,13,960	30.16

Purchased.

1921-22	166,304	90,07,898	54.16
1922-23	158,380	77,77,788	49
1923-24	103,041	47,86,049	46.44
1924-25	95,378	40,09,589	42

Total.

Year.	Tons.	Cost. Rs.	General supply rate per ton.
1921-22	268,116	1,23,57,029	46.1
1922-23	264,484	1,11,88,421	42
1923-24	206,998	80,45,274	38.85
1924-25	198,608	71,23,279	35.86

Conservation.—The large quantities of fodder required for annual consumption are stacked in specially appointed stack yards and thatched. In addition the fodder required on mobilisation has to be baled and is stacked in readiness at places where required. To minimise deterioration, baled fodder is stored as far as possible in corrugated iron sheds.

Silage.—Ensilage is extensively practised specially on dairy farms.

Green grass and fodder crops, large millet and maize are cut and chaffed during the monsoon period and put into pits or towers. The former is, in practice, as good as the latter and involves no initial expenditure. Horses do not, as a rule, care very much for silage, but they have been fed on it (part ration) with good results. It is, however, very much relished by horned cattle.

It is specially valuable in India for milch cattle and consumed chiefly during the hot weather months when no succulent fodder is available. The use of silage is essential to the economic working of a dairy farm. It can be stored for a considerable period and so can be preserved for consumption during seasons of drought.

APPENDIX.

*Revised sale rates of dairy produce on Government Military Dairies, from
1st July 1926.*

Dairy.	Milk per lb.			Butter per lb.		
	Government Institutions and Officers.	Troops.	Families.	Government Institutions and Officers.	Troops.	Families.
	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.
<i>Northern Circle.</i>						
1. Peshawar . . .	0 2 6	0 2 6	0 2 0	1 8 0	1 8 0	1 6 0
2. Cherat . . .	0 2 9	0 2 9	0 2 3	1 8 0	1 8 0	1 6 0
3. Khyber . . .	0 3 0	0 3 0	0 2 6	1 8 0	1 8 0	1 8 0
4. Rawalpindi . . .	0 2 6	0 2 6	0 2 0	1 8 0	1 8 0	1 6 0
5. Muree, Barain . . .	0 3 0	0 3 0	0 2 3	1 8 0	1 8 0	1 6 0
6. Quetta . . .	0 3 0	0 3 0	0 2 9	1 8 0	1 8 0	1 8 0
7. Sialkot . . .	0 2 6	0 2 6	0 2 0	1 8 0	1 8 0	1 6 0
8. Bannu . . .	0 2 6	0 2 6	0 2 0	1 8 0	1 8 0	1 8 0
9. D. I. Khan . . .	0 2 6	0 2 6	0 2 0	1 8 0	1 8 0	1 8 0
10. Manzai . . .	0 3 0	0 3 0	0 2 6	1 10 0	1 10 0	1 8 0
11. Razmak . . .	0 4 0	0 4 0	0 3 6	1 10 0	1 10 0	1 8 0
12. Dalhousie . . .	0 3 0	0 3 0	0 2 6	1 8 0	1 8 0	1 6 0
13. Kasanli . . .	0 3 0	0 3 0	0 2 6	1 8 0	1 8 0	1 6 0
14. Dagshai . . .	0 3 0	0 3 0	0 2 6	1 8 0	1 8 0	1 6 0
15. Subathu . . .	0 3 0	0 3 0	0 2 6	1 8 0	1 8 0	1 6 0
16. Jutogh . . .	6 3 0	0 3 0	0 2 6	1 8 0	1 8 0	1 8 0
17. Ferozepore . . .	0 2 6	0 2 6	0 2 0	1 8 0	1 8 0	1 6 0
18. Lahore Cantt. . .	0 2 6	0 2 6	0 2 0	1 8 0	1 8 0	1 6 0
19. Jullundur . . .	0 2 6	0 2 6	0 2 0	1 8 0	1 8 0	1 6 0
20. Ambala . . .	9 2 6	0 2 6	0 2 0	1 8 0	1 8 0	1 6 0
21. Gamber, Sargodha, Jallo & Matsonabad.	0 2 6	0 2 6	0 2 0	1 8 0	1 8 0	1 6 0
<i>Southern Circle.</i>						
1. Lucknow . . .	0 2 6	0 2 6	0 2 0	1 8 0	1 8 0	1 6 0
2. Cawnpore . . .	0 2 6	0 2 6	0 2 0	1 8 0	1 8 0	1 6 0

*Revised sale rates of dairy produce on Government Military Dairies, from
1st July 1926—contd.*

Dairy.	Milk per lb.			Butter per lb.		
	Government Institu- tions and Officers.	Troops.	Families.	Government Institu- tions and Officers.	Troops.	Families.
	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.
<i>Southern Circle—contd.</i>						
3. Agra	0 2 6	0 2 6	0 2 0	1 8 0	1 8 0	1 6 0
4. Allahabad	0 2 6	0 2 6	0 2 0	1 8 0	1 8 0	1 6 0
5. Jubulpore	0 2 6	0 2 6	0 2 0	1 8 0	1 8 0	1 6 0
6. Mhow	0 2 6	0 2 6	0 2 0	1 8 0	1 8 0	1 6 0
7. Deolali	0 3 0	0 3 0	0 2 6	1 8 0	1 8 0	1 6 0
8. Kirkee	0 3 0	0 3 0	0 2 6	1 8 0	1 8 0	1 6 0
Bombay Depot	0 4 0	0 4 0	0 3 6	1 8 0	1 8 0	1 6 0
9. Belgaum	0 2 6	0 2 6	0 2 3	1 8 0	1 8 0	1 6 0
10. Aden	0 3 6	0 3 0	0 2 6	1 10 0	1 8 0	1 6 0

2. Cream at Rs. 1-8-0 per lb. to all at all dairy farms.

3. Prices for separated milk to be fixed locally by administrative officers. Cash sales to be at one rate only, which must be the higher rate or officers' rate.

4. Discount up to a maximum of 10 per cent may be allowed at the discretion of administrative officers in the case of bulk supplies of milk and butter to troops.

5. The sale rates for dairy produce charged to hospitals at Nowshera and Mardan with effect from 1st April 1925 are as follows :—

	Rs. A. P.
Milk	0-2-6 per lb.
Butter	1-8-0 „
Cream	1-8-0 „

Oral Evidence.

2565. *The Chairman:* Lieutenant-Colonel Marriott, you are Director of Farms of the Master General of Supplies Branch?—That is so.

2566. The memoranda which you have provided are before the Commission, and we are greatly obliged to you for the clear statement you have given us. I notice on page 339 of your memorandum on the Work of Military Farms in India you say that as a result of a certain committee's recommendations there is now a division as between the dairy farms and the fodder farms?—That is so. About 1910 the Government of India was not altogether satisfied with the organisation and the general economic working of these grass and dairy farms, and a committee, composed of Mr. Fremantle, who was then in the I. C. S., and Colonel Henderson, a military accountant, toured India, and as a result of their recommendations a separation was made, and we now work in two sections. One section deals entirely with dairy farms and the other entirely with fodder farms. We work throughout India in "circles," and before the time of this committee one officer had charge of a circle including both grass and dairy farms.

2567. I understand you are prepared to-day to speak for both portions of the work?—I am. I am, so to speak, the managing director of this fodder production and this big dairy business. It is a wholesale and retail business; that is what it comes to. So far as anything technical is concerned, I would ask you to be good enough to visit one or two of our more important farms.

2568. I notice you are strongly in favour of the Commission making such a visit if possible?—Very strongly. You would see more in an hour than I could tell you in a day.

2569. Would you care to make any statement in addition to what you have said in writing, or would you rather proceed now by way of question and answer?—I am not clear what impression the Members of the Commission have gained from this memorandum. As you will realise, we cater entirely for the needs of the army, but it is economic; the Government of India would never have sanctioned the Farms Department otherwise. In the case of the dairy farms, it is entirely lack of private enterprise which compelled the Government to initiate them all over India. They have been very costly in the past; we have had to pay for our experience.

2570. I think you make the whole position very plain in your memorandum. You plainly show there that owing to the absence of a steady demand for first class dairy produce there has hitherto been no sign of the production by commercial undertakings of such produce?—That is so. That is the crux of the whole matter. We have bought our experience rather dearly, but at the same time it had to be done. Since the War we have put our house in order, and the dairy farms are now on a commercially sound basis. We are actually paying a small profit and interest to Government on the capital invested in these farms. I should like to hand in copies of our last report for 1924 and 1925. There may be some statements in them which may interest the Commission.

2571. You have handed in copies of a document entitled "General Administration Report on the Working of the Military Dairy Farms and Dairy Farms Department, 1924-25"?—Just as a company would, I publish for the information of the Military Department a statement of the year's working of the farms. I am sorry last year's figures are not yet to hand, but this report gives you the main figures, more or less. Our trading account is shown on pages 36 and 37. That is the consolidated trading account for all our farms in India, which shows you under the different headings given on the one side our main items of expenditure and on the other side particulars of receipts.

2572. We shall have an opportunity of looking into those, and we are obliged to you for handing them in. There are one or two questions of a

somewhat more general character which I wish to put to you. Would you like to express any opinion about a recommendation of the Inchcape Committee of 1922, to the effect that the dairy farms at Karnal, Wellington and Bangalore should be transferred from the Military to the Agricultural Department, which recommendations were given effect to in July 1923?—I do not think they wished to rob us of any farms, but the Civil side was very short of money at the time, and Bangalore was a very well-organised farm which afforded every facility for initiating a school for students of dairying and agriculture. There seemed, therefore, to be no alternative but to hand it over. The handing over of these farms did not affect us so far as our department is concerned; they were handed over on the specific condition that demands for milk for hospitals and for officers and men and their families should be met and no change made in the rates without reference to the Military Department.

2573. So far as the supply of dairy produce to the troops goes, the position has not been affected?—No. They are getting their produce. They are not supplying it so cheaply as we are in other places, however. We can now sell dairy produce cheaper than they can, and that is a rather important point.

2574. Does that mean the army is paying more for dairy produce from these farms which have been handed over to the Agricultural Department?—They have not increased their rates, but we have decreased our rates on other farms. The Bangalore farm is the most expensive by comparison and sells its produce at the highest rates.

2575. How many farms have you still in your hands?—I have at the present moment about 24 dairy farms, and we have a certain number of young stock farms.

2576. Is there any touch maintained between yourselves and the Agricultural Department with regard to the results of your breeding experiments, so far as the farms still in your hands are concerned?—Yes. We met last year at the Agricultural Conference at Pusa, and there we were asked our experiences of cattle-breeding and what had been the result of our experiments in the importation of bulls. The results are more or less embodied in this memorandum on Herds and Breeding Policy. One of our greatest handicaps, as you will probably realise, has been the impossibility of going into the open market and buying a pedigree cow. That difficulty existed when we started thirty odd years ago, and it still exists. That is why we have had to resort to breeding on such a large scale.

2577. Is it possible, in the state of efficiency at which you have arrived, to sell dairy produce to the public at a profit?—We are not allowed to. I am afraid that would be a difficult question to answer. To start with, it is very significant we have not had a demand for an ounce of milk from a single soldier in the Indian Army. It is beyond his price. We cater entirely for Government institutions, hospitals, institutions in barracks and officers and soldiers and their families. The only indication we have had of a demand from the public is at Lahore. Last winter we had to send a cart from Lahore Cantonment to Lahore, and we had several letters afterwards from Indian gentlemen of the standing of barristers and so on, civilians of that class, asking if we were prepared to sell to them.

2578. *Professor Gangulee*: Do you give concession rates to the families of British troops.—Yes. We have three rates.

2579. *The Chairman*: They are in the memorandum?—Yes. When you see one of our dairy farms you will realise at once that doing things in that style you cannot expect to sell your produce at the same price as a man in the bazar who has no capital expenses. Delivery at a man's doorstep twice a day is impossible, but unless you can bring the rate down to the bazar rate you get the hawker coming round who is prepared to sell to them. That is the real reason why we have to continue this concession to the families of married soldiers; people of that class are always prepared to take a risk if they can save a rupee or two a month.

2580. Has there been any proposal or suggestion to transfer those dairy farms which are under military control at present to the Civil Agricultural Department?—There has been no serious proposal that I am aware of.

2581. There has been no substantial proposal of that sort?—No, it has not come up. The matter has been mooted. As a matter of fact, the Imperial Dairy Expert did demi-officially put up a proposal to that effect 3 or 4 years ago.

2582. Is it your view that under present conditions the whole potential value of the dairy farms under military control in the matter of experiment, research, demonstration and propaganda can be made available for the public benefit?—They are open to the public at any time without restriction. We are only too glad to welcome anybody, whether an official or a private person.

2583. Have you any view which you would like to express as to the advisability of the transfer of some or all of the military farms to the Civil Agricultural Department?—I cannot see any particular object to be gained by it. I should certainly never recommend it to my own authorities. We have spent a great deal of money on organising our farms and buying our experience, and we know we can work our farms economically and sell our produce at a reasonable price. The farms are open to inspection, as I have said, by officials or private persons at any time.

2584. If it were possible by leaving the farms under military control to make further and wider use of them for the purpose of experiment, research or demonstration, and even perhaps for the purpose of attempting to encourage a public demand for a higher quality of dairy produce, would you look with favour on such a scheme?—You mentioned experiments. In my experience, that means money; you cannot make experiments without money. If, as Government insists, these dairy farms have got to attain financial equilibrium, we cannot indulge in experiments without losing money and so the private soldier will have to pay for it. There must therefore be a grant for experiments, but there is no reason why any of our farms should not be used. I should strongly recommend placing any one of them at the disposal of the Civil Agricultural Department, if they were prepared to pay for a particular experiment.

2585. You have described the circumstances in which certain of the dairy farms under military control were handed over to the Civil Agricultural Department. Can you tell me how it was those particular farms were chosen?—We chose Bangalore because it was rather out of our beat. It is situated in the south of India. Our next nearest dairy farm was Belgaum, so we thought if we had to give one up we might as well give up Bangalore. It suited the civil requirements exactly, and we thought it would be both gracious and generous to do so. Bangalore and Wellington went together. As regards the farms in the north, they first of all asked for Lahore. We opposed that, because Lahore is a very central farm. We have now a chain of these dairy farms from Lucknow to the frontier, and if one of the best in India were taken away it would break that chain. These farms are co-operative; they transfer cattle and produce; and to take the most important of them all away would have interfered with our organisation.

2586. What do you mean when you say they transfer produce?—If one farm happens to be short of butter it wires to the next fur, say, 100 lbs. Lahore might get a sudden demand for milk from a hospital and be unable to supply it all; it would then wire to the next farm for milk. That does not often occur, but it happens sometimes. In the end we offered them Karnal, which suited them and which is not really a dairy farm but more a cattle-breeding farm.

2587. I asked you this morning about demonstration and research in relation to the taking over of the military farms by the Civil Agricultural Department, and my question was directed to get from you whether you thought that more use might be made of the military farms for the purpose of research and demonstration without their being transferred from military to civil control?—These farms are now part and parcel of the organisation

of the army in India. The medical authorities are very strongly in their favour; even if we were to propose giving up any which were not paying, they would oppose it strongly. We should be only too pleased to co-operate in the carrying out of any experiments; only if they were costly we should expect a grant to cover the cost.

2588. You have made that plain, I think?—Were you not also referring to the possibility of expanding our trade?

2589. I alluded to the possibility of your expanding your sales to cover demands from the civilian population where a demand could be created, with a view to attempting to encourage a demand for high-class dairy produce for the good of agriculture generally?—Yes. That, of course, is opposed to the present policy. When these dairy farms were initiated it was distinctly understood there was to be no direct interference with private enterprise, and it was ruled that where we had surplus produce we could sell to a member of the I. C. S. or any other Government servant, but that was all. We were not allowed deliberately to go into the open market and open a depôt. Take Lahore, where there was an indication of a demand from the better-class Indian public for a guaranteed supply of dairy produce; I could not open a depôt at Lahore. If I did, I am convinced I could sell a lot of dairy produce. Again, our dairy farms are not designed to expand so very appreciably as that. All these dairy farms have been designed and built so as to produce a certain amount of produce for a particular garrison.

2590. I understand that. I do not know if you would care to add for the benefit of the Commission any views on the breeding policy that you have adopted, in addition to what you have set down in your very clear paragraphs dealing with that?—I do not think I have anything to add. What I have set down in my memorandum is what I stated at the Agricultural Conference at Pusa last year, and it was backed up by the Imperial Dairy Expert, Mr. Smith, who will probably give you evidence on the same subject later on. There is just one point I would like to explain. We have been rather forced to this breeding of half-breds or cross-breds. We only look on it really as a short cut to milk. We have discovered our most economical animal is undoubtedly the cross-bred, the product of an imported bull and a pure-bred country cow. We have proved conclusively by records that such a cow produces the best milk, keeps conformation and stamina, is a good doer and a really economical animal. As we have to produce milk for the army in India as cheaply as we can, we naturally go for what is considered the most economical animal. To keep up this strength of half-breds, however, we have naturally to keep up a large number of country-bred cows, and as we cannot buy a country-bred cow in the open market with any pedigree we have to breed both. From the last page of the Administration Report you will see that at the end of 1924 and 1925 we had 1,139 cross-bred cows and 1,214 country-bred cows. We have practically half and half.

2591. Are all those 1,139 first crosses?—No; we have still a fair number of three-quarters; we have not been able to eliminate them, and as a matter of fact what we have is really the residue of a large number which we had to cast.

2592. All your experience goes to show that the first cross is the best animal?—She is a really economical animal.

2593. As regards your military grass farms, is all the fodder that you handle grown on the land that you control?—No. Our policy is to produce where it is economical or where we have the facilities, and to buy the remainder. Our total requirements of fodder for the army in India in 1924-25 were 212,809 tons. We produced 103,000 tons and purchased 95,000 tons. It is approximately half and half. There are, of course, many places where we cannot produce. We have very large issues of fodder on the frontier. At frontier posts like Quetta, Fort Sandeman, Razmak and even Peshawar, if we wanted land we could not get it without being unfair to the local zamindars,

and to dispossess them in any of these places where land is so valuable and scarce would be to cause an outcry.

2594. What I was really concerned to discover was whether you made any hay or ensilage of bought grass?—No. We might make, in places, ensilage of bought crops such as millet, the common *juar*, which grows so well in the monsoon. If we were short on our own land we might go into the market and buy a few tons of it, chaff it and put it into a silo pit, but ordinarily we make our own silage from our own produce.

2595. Have you found that the practice of ensilage making and hay making that you carry on on your own farms has interested local cultivators in the neighbourhood?—No, I cannot say it has. Hay making is entirely foreign to the Indian and does not appeal to him at all.

2596. What I was concerned to discover was whether the fact you were prepared to buy and were daily demonstrating what you were doing did not encourage local cultivators to copy your methods and sell the result to you?—No, I cannot say it has had that effect. Even during the War, when our demands went up to such huge proportions, we had in the end to fall back on the Forest Department as an agency to get our stuff. What little local grass is available they either cut green and sell, or graze it for choice.

2597. What is your experience as between hay and ensilage as food-stuffs?—Ensilage we use entirely as a substitute for green fodder in the hot weather. This being such a dry country in the hot months, it is very expensive to cultivate crops. We have to irrigate constantly, and we are short of land in many places. The only way we have of getting a green ration for the cow is resorting to ensilage. We do not, of course, feed a full ration of ensilages probably in the hottest months we feed them half and half, or two-thirds ensilage and one-third hay. They always get a proportion of hay with the ensilage.

2598. Which type of food do the animals go for first?—They are very fond of ensilage. There is no doubt about it; in the hot weather they appreciate anything green, but they eat the hay too.

2599. Is there anything you wish to say about the quality of forage made from grass grown in forest areas? Have you any experience of that?—We only resort to the forest areas in case of emergency or heavy demand. During the War, for instance, without the help of the Forest Department we would never have got the quantities of hay we wanted; but under normal peace conditions we are independent of them. Of course, their hay is naturally rather coarse on the whole, but when you are forced to get something it does all right.

2600. *Mr. Calvert*: I have heard the complaint (I cannot tell you its source now) that you buy some of the highest yielding cows, and by crossing you take them away from the country's stock of good cows. Your cross-bred cow in time ceases to be in milk?—There is truth in that statement, but so far as robbing the country goes it may interest you to know that in the last two years we bought exactly 8 cows, so I cannot see how we have affected the Indian market in any way. We have worked up our herds so that we breed sufficient country cows for our own stock to cross with the English bull.

2601. So you are not interfering with the attempts to establish these pure herds of cows?—No; I do not think the purchase of 8 cows would affect India in any way. This year I am going to buy a few more, 40, in fact, but I do not think that will affect the position either.

2602. In answer to the Chairman, I think, you said you welcomed visitors to these dairies?—Very much.

2603. We have to thank you for your very great courtesy in allowing our co-operative staff to visit you?—We are only too pleased.

2604. Does that apply to any visitors?—As far as I am concerned as Director I should welcome anyone, and I think our managers would too.

2605. *Professor Gangulee*: These military farms are considered to be the first organised attempt in India to run the dairy industry on a large scale?—Yes; I think the answer is certainly in the affirmative.

2606. Having in mind, therefore, the pioneer nature of the work undertaken by the military dairies, can you tell us what assistance you have obtained in the past from the Department of Agriculture?—I think we have been working independently, because until they started their Pusa dairy I do not think they had ever treated the subject seriously.

2607. It has been asserted by the Agricultural Adviser that cattle-breeding operations in India were started about 25 years ago?—I think our first dairy was started about 1890, 36 years ago.

2608. In planning out your farming operations, do you receive any useful help and suggestions from the results of experimental researches being conducted in India?—I think we are going to get some useful help from the chemist working on nutrition values of foods at Bangalore. We have had enormous assistance from the Muktesar laboratory; as I told the conference at Pusa last year, what used to be an absolute nightmare to us is now nothing; we do not mind rinderpest at all now that simultaneous inoculation has been introduced.

2609. Then you have got help from veterinary research?—Great help.

2610. But not from the Agricultural Department?—I would not say that. Anything we refer to them they are only too glad to help us about. If we want to know anything about a particular fodder crop we write to Pusa or Lyallpur. They have always assisted us.

2611. Is that of recent origin?—We have been dealing only with the simple, staple fodder crops of India. As far as crops go, we have not had any deep questions of research.

2612. It is not only with reference to the fodder crop but to cattle-breeding, I want to know what assistance you received from the Department of Agriculture?—Since the Pusa herd has been established we have interchanged bulls, and things of that sort, and both my Assistant Controllers of Dairy Farms have visited Pusa and seen the herd and learnt certain lessons from seeing their methods there.

2613. Do you conduct any experiments or trials on your own farms?—Beyond breeding experiments, I do not think we have. We have merely worked straightforwardly, our object being to produce milk and butter as cheaply as we can.

2614. You have attained this stage of efficiency or excellence without any experimentation either on farms or in laboratories?—You must remember the dairy farms have cost Government a quarter of a million pounds, and a lot of that has been spent in experimenting in cattle, crops, buildings and so on. We have bought our experience in the last 35 years.

2615. Through a definite series of experiments?—We have spent a lot in reclaiming land, cropping it and so on.

2616. Has the management of the farms been in your hands since the start?—I have been administrator of these farms for the last four years.

2617. Are the men at the head of these farms trained men?—I have 3 whom I may call expert dairy farmers, we call them Dairy Experts. One has been with us for a long time; he started life in the colonies, and came to us with a certain amount of knowledge. The second is a younger officer who came from Australia armed with diplomas; he has a lot of technical knowledge. The third has worked his way up; he has served his apprenticeship in the Farms Department itself.

2618. With regard to your breeding work, I was greatly pleased with your short summary in the memorandum you placed before the Commission. You have dairy farms in various centres. Do you follow a clear-cut policy as to the classes of stock maintained and breeds kept?—Yes. Every farm has a breeding policy of its own. Some farms do not breed at all; Kirkee does not breed an animal. I keep nothing there but half-breeds and cross-breeds. It

was so costly in the past it did not pay, so now they draw entirely on some other farm.

2619. Have you a herd register?—Yes, for our pedigree animals.

2620. After all these years of experience of dairy management, could you indicate the direction for realising your motto "Feed and breed" in other dairy farms of the country?—When it comes to breeding, I think if you could only get some of the big landlords and Princes to take an interest in it it would spread, but until you do that I do not see how you are going to get pedigree herds in this country, unless Government are prepared to come into it and buy huge blocks of land.

2621. I entirely agree. Do you employ a large number of agricultural labourers on your farms?—A large number.

2622. Do they all come from the neighbouring villages?—In the harvest season we have to import a large number. That is one of our most difficult times, October to December. We have to import large numbers on our grass farms from the United Provinces, where labour is generally most plentiful. Otherwise, we always have the minimum number housed on the premises. That is for everyday work.

2623. They do not all come from the neighbouring villages?—A certain number do; the practice varies on different farms. The number varies according to the size of the farm. We give them quarters and they live on the premises and are detailed each morning for specific jobs.

2624. Do they possess any land themselves?—I should very much doubt it, judging from their standard of living.

2625. Do you notice any change in the matter of fodder cultivation and dairy management amongst the farming population in the neighbourhood of your farms through your example?—No, I cannot say I have.

2626. You would agree with me, I take it, that good farming in a sense is infectious, just as bad farming is contagious? The point is this. One would imagine that a farm carrying on the dairy business and doing it well and growing good fodder would infect the people in the neighbourhood. Is that your experience?—No, I cannot say it is. Most of our farms are cantonment farms, and taking it all round, especially in the north, the standard of cultivation is very high in the neighbourhood of cantonments.

2627. In some farms you are trying to grow lucerne. I am interested in that particular crop. What success do you have with lucerne?—We do not grow a tremendous lot of it; we find it rather an expensive crop. We find we get more bulk out of other fodder crops. We like lucerne on our grass farms because it is a fodder relished more by horses than any other.

2628. It has more nutritive value?—The crop we have had most success with is Egyptian clover, especially in northern India. It is a common average to get 20 tons an acre.

2629. Do you practise intensive manuring?—Yes, certain plots are always down to intensive cultivation, and those are always heavily manured.

2630. With cattle dung?—Yes.

2631. What quantity of fodder do you buy from the Forest Department?—In ordinary times, nothing. Dehra Dun is the only farm I can think of where we lease a few forest blocks from them. We do the cutting and the harvesting.

2632. With regard to cattle diseases and young stock, I notice in your list of diseases you do not mention blackquarter. Is your young stock susceptible to blackquarter?—No; we have never had any cases. The list you see here is taken from the veterinary statistics of all-India, because of course any disease we have is at once reported to the local officer of the Royal Army Veterinary Corps, and he takes the whole thing in hand.

2633. I find foot and mouth disease is bad?—That is always with us: there is hardly a month in the year without it,

2634. What do you do with cattle affected with that disease?—They are isolated and their mouths are washed and they go through a bath. They recover in about a fortnight; it is an exception to get a death.

2635. You do not slaughter them?—Never. It is exceptional to have a death. We look on it as a matter of course; it is always with us; you cannot stamp it out. As long as it is rife throughout India little can be done; cattle must pass our farms from the districts, and our bullocks must go out at times; they probably bring it in as a rule from the public roads.

2636. Are you aware of the intensive measures taken in Great Britain to stamp out this disease?—Yes, but I think the conditions in Great Britain and India are different.

2637. *Sir James MacKenna*: What is your experience of second crosses?—Do you mean half-bred and half-bred?

2638. A half-bred heifer and a pure-bred bull?—We have had a certain number, and what we find is this: the percentage of failures is greater than with the half-bred. With the half-bred we can count on 99 per centum being economical animals, and so we have rested content with that.

2639. It looks like a predominance of the father?—Yes.

2640. It rather peters out in the second generation?—Yes.

2641. Are all your herds inoculated on the simultaneous inoculation method?—Yes. Every year on every farm the veterinary officer of that particular district arranges with the local farms officer for animals that have not been inoculated to be inoculated.

2642. Simultaneously?—Yes, always.

2643. Do you find any difficulty in the application? Have you any bad reactions amongst the cattle?—In the list to which I have already referred to it is shown that we have had 113 cases of rinderpest. That is abnormally high, and for 1925-26 I do not think it would be 20. That was entirely due to cases of pyroplasmosis resulting.

2644. Do you carry out any systematic investigation of fodder crops?—With regard to their nutritive value?

2645. Yes, and the introduction of new varieties and so on?—This year, as a matter of fact, I have imported a number of varieties of heavy-yielding fodder oats from England. One of my officers has been to Reading for a course of six months, and we have got him interested in this subject and are experimenting with this. We have been doing this sort of thing in a mild way for the last few years, but this time we are going to go about it a little more seriously.

2646. The results of these experiments will be valuable to the agriculturist?—I believe those we are going to do now will be. There is an officer in charge of it and everything will be recorded properly. In the past experiments have been a little too haphazard to justify publication.

2647. To that extent, of course, your results would be transmitted to the Agricultural Department and probably save duplication?—Yes.

2648. *Sir Henry Laurence*: Is it the policy of your department to supply all the milk requirements of the Army, or what proportion do you suppose you are now supplying?—Are you talking of dairy produce or fodder?

2649. I mean dairy produce, milk?—No, we certainly do not, only in certain stations where it has really been found necessary to establish a military dairy. We probably should have had more, but the dairy farms were losing such a lot a few years ago that they absolutely refused to go on with them until we had really obtained financial equilibrium.

2650. About what proportion of the necessary supply are you able to provide in those stations where you have these dairy farms?—We do everything; where a Government dairy farm is established, the troops have to deal with the farm.

2651. And you supply the whole of the milk that they drink?—The whole of the milk and butter. I am talking of British troops; the Indian troops are independent.

2652. Then you do not propose to extend your operations further?—I will not go so far as to say that; we opened a dairy farm in Nershera last year, but the policy is rather, if we extend, to extend in the north rather than the south.

2653. At the present moment you are running them at a profit?—We are making a profit now.

2654. Apart from capital depreciation?—We have a depreciation reserve fund from which we meet our requirements and casualties. The Government have now allowed us a reserve fund. We have a *pro formâ* account with the Government in which we put our profits, so that in the event of a bad year we do not have to advance our prices.

2655. Then in addition to giving pure milk to the army in these places, you are carrying out certain experiments and showing the value of selective breeding?—We have one herd which I think you will be very interested to see; we have the Ferozepore country-bred herd which has been going now for the last 16 or 18 years; that is a pure country-bred herd and the records are very interesting; they are very economical animals.

2656. From this very interesting table of yours on page 9 of this report I see that with a much smaller herd you have been able to increase the cows that give over 4,000 lbs. of milk per annum nearly five-fold, and, over 5,000 lbs. nearly ten-fold, over 6,000 nearly twenty-fold?—I put that in purposely to show what progress had been made since 1912-13 with our breeding experiments.

2657. It is very striking progress indeed?—I think it speaks for itself; that is one of the reasons, of course, why we were able to work financially so much more successfully.

2658. I think we may congratulate you on this table. Now take your best animals, how do they compare with the milk-yield of good milkers in the United Kingdom? What do you hope to rise up to?—Well, of course, what we hope to do is to get our largest number between 4,000 and 5,000. At present if you notice, in 1912-13 our largest number of animals was between 1,000 and 2,000 lbs. If you look at that table you will see how we went to work; I think myself in another few years we ought to predominate in the 4,000 to 5,000 lbs. grade. At present we predominate in 3,000 to 4,000 lbs.

2659. That is I think the result of cross-breeding and selection?—Yes. We are now practically breeding all our country cows for these cross-breeds; we have to keep a large number of country cows, of course, milked in the ordinary way.

2660. For this herd of 1,500 cows how many English bulls do you maintain?—We had 48 pure-bred bulls last year. We had 18 casualties; we had rather a bad year; a lot had come out all together and had got useless, so we had a big condemnation. 6 have just come out now. We are getting British Friesian at present.

2661. You selected Ayrshire and Friesian?—We are buying entirely Friesian at present.

2662. Have you experimented with other breeds?—In the past we experimented with Shorthorns but we found the Friesian stock in Lucknow are the best.

2663. Have you enough data to compare over a period of years to show that the Friesian is really the best mate for cows in India?—I will not say that because we have not been going long enough, but I think the Lucknow experiments justify our going in for them rather more extensively. We shall in a few years be able to compare the two.

2664. What about other breeds at home?—We stuck to the Ayrshire for so many years, and in the past we had such a conglomeration of mixtures of breeds that we do not want to add to them.

2665. The selection of the Ayrshire in the first instance was an accident, was not it?—No, it was on the direct recommendation of Mr. Smith whom we originally got out as a Dairy Expert of the department; he was a Scots-

man, he had had a good deal to do with Ayrshire, and I think his recommendation was a very sound one. The first two or three lots we got out were remarkably good; they gave us very good results.

2666. But before Mr. Smith's day were there any experiments to show which were the best?—No, they were never kept.

2667. How long has he been out?—I think he must have come out about 17 or 18 years ago.

2668. Then on page 345 you mention the outbreak of rinderpest, 113 animals; were those animals which you lost?—I am sorry to say the veterinary report did not give the number of deaths; but looking back, as far as I can remember, the percentage of deaths was about 25 or something of that sort.

2669. Is that in spite of the application of the serum-simultaneous method?—Well, as I was telling you, something went wrong with the brew that came down from Muktesar; but we have had practically no cases in the last 18 months.

2670. *The Chairman*: Was there any suggestion that the outbreak of rinderpest was produced by the inoculation?—Yes, that was the whole trouble; there was something wrong with the brew. You must have an accident occasionally; it was the only big one we have had.

2671. *Professor Gangulee*: Have you gone into that carefully and traced the origin?—It was dealt with by the Director of Veterinary Services, because his officers were concerned in respect of their professional reputation. They went into it very carefully. Of course, a lot of it was between themselves, and we did not ask any questions.

2672. *Sir Henry Lawrence*: The expenditure of your Department is roughly 30 lakhs on dairy farms?—Yes. I think we were nearer 35 lakhs this year. The turn-over for our dairy farms is about 35 lakhs.

2673. You get that all back with a little profit now?—Yes, as things are going at present we are working at a profit of about a lakh after paying interest to Government.

2674. *Sir Thomas Middleton*: In answer to Sir James MacKenna you indicated that the three-parts bred animals were not satisfactory. I think you were referring to three-parts Ayrshire: that is to say, the Ayrshire bull on the half-bred Ayrshire heifer?—These three-quarters and seven-eighths were all the Ayrshire bull again on the half-bred and the three-quarters, and so on; it was the re-introduction of further English blood.

2675. They were unsatisfactory, I understand mainly because the constitution was bad; they could not stand the climate?—That was the chief reason, yes.

2676. You have not yet had experience with the Friesians sufficiently long to enable you to determine whether the three-quarter bred in that case is also constitutionally weak?—The answer is No, because when all is said and done, we have got a few in Lucknow which I hope you will see later. It was not quite fair to judge the experiment on them alone.

2677. Is the climate in which many of your farms are situated very different from the climate in South Africa in which the Friesians do so well?—I have never been to South Africa. In the Punjab and United Provinces the temperature is up to 115 and 118 for certain weeks of the year; I know these English bulls got rather tucked up during the first year or so.

2678. Your Friesians have come direct from England, not from South Africa?—We got them from the British Friesian Society.

2679. There are a number of technical points which we shall be able to go into when we visit the farms; I do not think I will take them up now. You have given us the area, the produce and the cost per ton of fodder. Am I right in thinking that these costs refer to baled hay in every case, that ensilage is not included at all there?—I have got the statement you want; "Quantities of fodder dealt with and cost." That includes everything.

2680. Ensilage as well as baled and dry fodder?—Everything we produce, and in the cost of production is included a share of overhead charges.

2681. I wanted to get the cost of the hay, it is mixed hay and ensilage?—On our grass farms I suppose the percentage of ensilage is not 2 per cent.; we make very little ensilage on our grass farms, because it is entirely for Government horses, and we have not yet educated the Government horse up to eating it in any quantities; it is negligible compared with 100,000 tons.

The answer is that this refers to dried fodder really; the ensilage is negligible.

2682. *The Chairman*: There is no green fodder in those figures?—If you look at statement 8 on page 20 of the Administration Report, you will see the actual quantities and varieties of fodder issued. The quantity issued in 1924-25 is only 1,100 tons, hay was 110,000 tons, and green grass was 24,000 tons.

2683. That is all in the figure mentioned by Sir Thomas Middleton?—Yes. we have to bring everything down to a common basis, and everything is to a scale; we have a scale of equivalents for every class of fodder for the different times of the year.

2684. *Sir Thomas Middleton*: Because there is shown here the quantity of dried material?—That is all.

2685. It does not include ensilage?—No, it includes the equivalent. It includes every class of fodder brought down to what we call a hay basis. If you want to find out the cost of ensilage on any farm, you have to go to that farm's particular accounts, because from the administrative point of view the Government are quite satisfied with this, and I do not know that it would help them much to say that ensilage had cost so much.

2686. I do not question the method of setting it out; I only wanted to know exactly what it was.—Everything is brought down to a common denominator or basis.

2687. *Dr. Hyder*: Have you ever been in command of Indian troops?—I have been in an Indian Regiment.

2688. Do they drink milk?—They are great milk drinkers, they drink all they can afford to buy as far as I can see; but they keep their own buffaloes as far as I can make out; it is a regimental concern entirely.

2689. Not in the lines?—Well, they buy it from the bazar.

2690. At present you do not supply any milk to the Indian units?—No; I should be very pleased to.

2691. I cannot see the reason for your statement that there is no demand on the part of Indian troops. Look at your table giving the prices per lb. of milk. If I take Peshawar as being the most important, your rate for the troops is annas 2 and pies 6 and the same rate at Allahabad and Lahore?—Those plain stations are practically all the same; those are flat rates.

2692. A pound is equal to one-half seer, is not it?—That is annas 5 a seer.

2693. What price does an Indian pay when he buys milk from outside? He must pay annas 5 or more?—I cannot tell you; but even on the frontier where they have not got the local *gowala* to resort to, they will only take milk from us when we reduce the price and have it surplus; I do not know why it is.

2694. Does the Indian soldier buy it at annas 3?—I do not know what the explanation is, but they make regimental arrangements for their milk supply: I presume the men are satisfied and I presume they get it cheaper. There is certainly no demand on our military dairies.

2695. *Mr. Calvert*: Up to quite recently the Indian soldier was not given rations and the British soldier was. It is only recently you have been giving rations to the Indian soldier, and if the rations given to the Indian soldier do not include milk, it does not come from you?—But the British soldier pays for his milk.

2696. Is it not included in rations as well?—No, he has to pay hard cash for it; he gets no milk in his ration.

2697. *Dr. Hyder*: I find from the Administration Report of your military grass farms that the price per ton of the fodder which you produce is Rs. 30, whereas the cost per ton of the supplies you purchase is about Rs. 40. There is a difference of Rs. 10. Do you not think that is an important matter? What obstacles are there as regards extension of your military farms?—It is a question we have gone into and it is a question which the Braithwaite Committee took up. That was the Committee that preceded the Inchcape Committee. The remarks of the Braithwaite Committee were accepted by the Inchcape Committee. They said: "We are satisfied that fodder is produced economically on the Government grass farms, but we are not prepared to recommend such extension of their operations as would more nearly meet the fodder requirements of the army. Our reasons for this opinion are that in most places where extension is economically possible the demand is at present adequately met, and where extended operations might be desirable it is impossible to obtain the land required." Now that applies largely in the north of India where we have very large demands all along the frontier.

2698. It is perfectly true that perhaps you could not acquire land in such insecure areas, but what difficulty would there be in having your farms in the canal colony areas, where your best depôts are?—But if you can buy the same class of fodder locally, you save all the cost of baling and handling. The moment we start to handle it, up leaps the price.

2699. Freight would be Rs. 10 from Lahore or any other military grass farm you have to any point on the frontier?—It would cost far more. Rs. 10 a ton, at 28 maunds to the ton, would only be about annas 6 a maund. To bale fodder alone costs you annas 10, because you have to wrap it, and for hay it is annas 4 a maund.

2700. *The Chairman*: Do you have to wrap it?—Yes, it is chaffed straw; it is threshed on the ground in the old fashioned manner. If you have to handle it and send it a long way, all the corners and edges go and you have lost 15 per cent. by the time you can issue it.

2701. *Dr. Hyder*: I find from your Administration Report that in the Orders of the Government of India prescribing the rates for the sale of your produce you have certain rates for officers and Government institutions and also for the general public. In reply, I think, to the Chairman, you said there was no demand on the part of the general public in urban areas?—Are the words "general public" mentioned in these reports?

2702. Yes, if you look at page 11, the appendix, paragraph 2?—Of course that was put in because I will not say we have not sold a little where we have a surplus; but it is not the practice to do it, and it is only done where there is no question of anyone engaged in private enterprise taking exception to it. For instance, I will give you a case in point; we were supplying Falletti's Hotel in Lahore. Granted, a large number of military officers were living there, but the majority were the public. Mr. Falletti came to me the other day and said: "Mr. Keventer is opening in Lahore, we must drop your trade." I said: "Certainly, of course you must." In that case we should have been interfering with a man like Mr. Keventer who does conform to a standard more or less like ours. If we had tried to induce Mr. Falletti to continue patronising us it would have been a direct infringement of this principle.

2703. Are his rates the same as your rates?—We can generally undersell him, but then he has to make a bigger profit.

2704. *The Chairman*: I will put these questions on behalf of Sir Ganga Ram. At present you destroy or give away the fresh-born calves. Is it possible for you to keep them for one month, so that zamindars could take them away; you may charge them annas 8 per day and zamindars would be glad to take them? This will improve the general breeding of the cattle throughout the country?—As far as destroying calves is concerned, we destroy no calves; we give them away and a certain percentage die, but the

majority are given away. As regards rearing a certain number of animals at annas 8 per diem for zamindars, I should be very pleased to do so, provided you guarantee that the particular zamindars will take them away when they are ready to go.

2705. Do you give salt to the cows? How much salt do you consider necessary for them?—We do, a quarter of an ounce per diem is the ration.

2706. *Dr. Hyder*: Every day?—Yes, it is mixed up with the ration.

2707. *The Chairman*: In the Military Department you keep a reserve stock of pressed *bhoosa*. Is it possible to make use of the scientific method of ensilage for keeping the stock of *bhoosa*? Have you ever tried the Agriculture Department to show you the method of ensilage?—The Military Department keep up a very large stock of what we call mobilisation reserves of fodder. I am not quite sure whether Sir Ganga Ram is referring to that. It is 12,664 tons. That is compress of hay and white *bhoosa*. That is kept, of course, for war purposes; it must be baled, it must be ready to be moved about at a moment's notice. Any question of putting it in an immobile state would be impossible.

2708. There is a question I wish to ask. Can you give us the cost of inoculation by the serum-simultaneous method;* does it happen to be included in those figures?—This is a copy of the standing orders. I rather think it is in this. We pay the price fixed by the Government of India to the Muktesar Research Institute for so many doses which we indent for, and the rest is practically done free by our own staff and an officer of the Royal Army Veterinary Corps. May I ask if you could arrange to visit two or three of our more important farms?

2709. I could not commit myself to-day; I think you may take it we will do so if possible?—May I suggest three stations, Jubbulpore, Lucknow and Lahore. Jubbulpore is the centre of the administration. At Lucknow you could see some of these very interesting half-breds and three-quarter breds which I think Sir Thomas Middleton would like to see. Lahore is one of our best farms. I should very much like to take down two or three Commissioners to Ferozepore to see the pure-bred country herd.

(The witness withdrew.)

* Annexure.

ANNEXURE.

Cost of inoculation of cattle against rinderpest by the serum simultaneous method.

1. The cost of serum is 3 annas per dose of 5 c.c. at Muktesar. *Add 5 per cent for bottling, packing and freight, the cost per dose is 3 annas 2 pies.*

2. Doses of serum for different classes of animals and cost are:—

Class of animals.	Doses of serum in c. c. per 600 lbs. body weight.	Cost per animal.
		Rs. A. P.
Pure Ayrshire and Holstein	250—300	11 14 0
Half-breds	125—150	5 15 0
Country-bred Sindhi	60	2 6 0
„ „ Sahiwal	40	1 9 4
„ „ Haryana	30	1 3 0
Buffaloes	60	2 6 0

**Mr. D. G. HARRIS, C.I.E., Deputy Secretary to the Government
of India, Department of Industries and Labour,
Public Works Branch.**

**Memorandum on Irrigation in India by Mr. W. Roche, Offg. Deputy Secretary to
the Government of India, Department of Industries and Labour (P. W. Branch).**

Irrigation Statistics.

The growth of irrigation in India can be best illustrated by the following figures showing the area irrigated from Government works for each of the trienniums 1901-04, 1911-14, and 1921-24:—

Average 1901-1904, 20.41 million acres.

„	1911-1914, 24.24	„	„
„	1921-1924, 27.47	„	„

The maximum area recorded was in 1922-23 when 28½ million acres were irrigated. Statistics are available up to the end of the year 1923-24 and show that the total length of main and branch canals and distributaries then in operation amounted to some 67,000 miles. The total capital outlay (direct and indirect) on productive and unproductive irrigation works amounted to Rs. 8,385 lakhs. The working expenses during the year 1923-24 amounted to Rs. 355 lakhs while the estimated value of canal irrigated crops in that year was Rs. 147½ crores.

Relations of the Central Government with Local Governments.—“Water-supplies, irrigation and canals, drainage and embankments, water storage and water power” are reserved provincial subjects: they occupy, however, a unique position amongst the reserved provincial subjects in that the powers of Local Governments are limited, and the sanction of the Secretary of State is necessary to capital expenditure upon irrigation and navigation works, etc., in any of the following cases, namely:—

- (a) where the project concerned materially affects the interests of more than one Local Government;
- (b) where the original estimate exceeds 50 lakhs of rupees;
- (c) where a revised estimate exceeds by 15 per cent. an original estimate sanctioned by the Secretary of State in Council;
- (d) where a further revised estimate is proposed after one revised estimate has already been sanctioned by the Secretary of State in Council.

The effect of the imposition of the above financial limits is to tighten the control of the higher authorities in those cases in which the amounts prescribed are exceeded and to transform the control from a general to a detailed and technical one. Nominally, this control rests with the Secretary of State in Council, as it is his sanction which is required to the projects in question, but, actually, he maintains no regular technical advisers in irrigation matters and consequently he exercises it through the Government of India. The objects of the limitation imposed upon the powers of Provincial Governments may be generally stated as follows.

In the first place, in a subject so technical as irrigation, there are only limited means available for the exercise by the Government of India of the powers of superintendence, direction and control vested in them by the Government of India Act, apart from the scrutiny of major projects before and after sanction which the limitation entails. Secondly, it ensures that all large schemes are submitted to the technical scrutiny of an expert engineer other than those entrusted with the framing of the proposals before sanction to them is accorded. Thirdly, it has the effect that no Province

can be committed to heavy and recurring expenditure on an irrigation project until the Secretary of State and the Government of India, upon whom the ultimate responsibility to Parliament lies, have had an opportunity to satisfy themselves, as far as may be possible, that the investment is, from all points of view, a sound and justifiable one.

Research Work by the Central Government.—The Board of Agriculture in India at a meeting held in 1917 recommended *inter alia* "That a special Imperial officer of agricultural experience with a suitable staff be appointed to investigate the water requirements of crops and that an experimental station or stations be selected for this research work by the staff after it has been appointed." The Government of India were in full accord with the Board of Agriculture in regard to the importance of this problem, but before committing themselves to the detailed scheme recommended by the Board they thought it desirable to hold a preliminary enquiry. For this purpose they decided to place two officers on special duty to consider and advise on what lines the main scheme should proceed, and in particular how far experimental research into the water requirements of crops should be centralised and how far it could be carried out through Provincial Departments of Agriculture. The scheme, however, did not materialise owing to the necessary staff not being available owing to the War.

Subsequently the Government of India had under consideration the necessity for the appointment, under the Inspector General of Irrigation, of a technical officer with a suitable staff for the collection, collation and dissemination, throughout India, of technical information and statistics in connection with irrigation works. They were convinced that it would be of the greatest benefit to all Local Governments if the information and statistics that were available only to the officers in individual Provinces or were stored in the archives of the local Secretariats could be made available for general use throughout India. Further they considered that there was great scope for new investigation and that it was essential that direction and continuity should be ensured and that a central collecting and distributing agency should be established in connection with any investigations that might be made. Local Governments were accordingly addressed in the matter, and their co-operation was sought. The proposals of the Government of India had, however, to be dropped as some Local Governments could not spare the necessary staff.

A considerable amount of useful work has, however, been done in the past by the Government of India by the collection and dissemination of technical information and statistics relating to irrigation—

- (i) by the publication of technical papers, and
- (ii) by holding engineering conferences, *e.g.*, the Irrigation Conference of 1904 and the Engineering Conference of 1913.

Oral Evidence.

2710. *The Chairman:* Mr. Harris, I think you are relying on the memorandum prepared by Mr. Roche, are you not?—Yes, he was doing my work while I was on leave; I have only just returned from leave.

2711. Would you like to make anything in the nature of a statement to the Commission before we proceed to ask you one or two questions?—I do not think so; Mr. Roche's memorandum is merely a statement of facts.

2712. Could you give me an idea of the scope of your duties?—At the moment I am doing the work of two posts, both that of Deputy Secretary and that of Consulting Engineer. As Deputy Secretary I deal generally with the administrative side of irrigation works, with the whole of the establishment of the Public Works Department, and with what are known as Central Works, that is to say, buildings and so forth, undertaken by the Central Government for their own purposes. As Consulting Engineer I am responsible for advising the Government of India on all projects which come before them.

2713. Are you the only officer advising the Government of India in matters touching irrigation?—Yes.

2714. Some alteration in the office charged with the responsibility for advising the Government of India in matters of irrigation has been contemplated, has it not?—Yes, the matter is at present under discussion.

2715. How long has it been under discussion?—For rather over 18 months. We addressed the Secretary of State last year; the India Office held the matter up for a very long time, and then sent us back a reply which necessitated a reconsideration of the whole position.

2716. Have you held this post for 18 months?—Since April last year.

2717. Does the fact that the matter is under discussion and consideration make it difficult for you to answer our questions on the matter of posts and responsibility, do you think?—It might possibly be easier if I did so in private, as then I could refer to official correspondence on a subject on which a decision has not yet been reached; but if you would sooner it were done in public, I do not think there is really any very grave objection to it.

2718. I would sooner it were done in public, if you will agree to give us your views. If, on the other hand, you wish to be heard *in camera*, I shall clear the room?—I suggest that I describe the position generally, and if there are any detailed points you would like to ask about, perhaps I could answer those questions in private. I can tell you generally how the situation stands.

2719. Yes, I wish you would?—Well, the position is this. My predecessor, Sir Frederick Gebbie, who held the post of Consulting Engineer for about 3½ years, found great difficulty in discharging the responsibilities which the post involved. The position had changed completely with the introduction of the Reforms. Prior to the Reforms, all major irrigation works were constructed from funds provided by the Government of India; that is to say, the works really belonged to the Government of India, and the Provincial Governments acted as agents of the Government of India in regard to them. The Government of India took, in some cases all, in some cases a share, of the revenue from them. In such circumstances the Consulting Engineer, or the Inspector General as he was then called, was actually the representative of the owners of the works. With the Reforms there came a complete change in the whole position. Under the new system, the money was found by the Provincial Governments; the revenue from the works belonged to the Provincial Governments, and the Provincial Governments were not willing to accept the same detailed control as in the past. The Inspector General in the past was a super Chief Engineer; he said "Do this" or "Alter this" and Local Governments had to obey. That position became quite impossible with the introduction of the Reforms and many Local Governments became impatient of control by a touring headquarters officer. My predecessor pointed out the difficulties of his position, that in many cases the Local Governments did

not require his services, that he only visited them because he had to, and that he was never quite sure that he was getting the full information necessary to enable him to discharge his duties properly. In one case he certainly did not get it, and the Government of India were let in. In those circumstances he could not take the responsibility which his predecessors had taken before the Reforms. Provincial Governments were addressed on the subject, and the general consensus of opinion was that, while it was very desirable that they should be able to get a second opinion on irrigation projects, they did not want any interference once the project was sanctioned. The Government of India then proposed that in place of the Consulting Engineer there should be constituted a Central Irrigation Board. They suggested that all the Chief Engineers in India should be members of this Board, and that when a new project came up for sanction (and all projects costing more than 50 lakhs of rupees have to be submitted to the Secretary of State for sanction) the Government of India should convene a sub-committee of this Board, consisting of 3 Chief Engineers with recent experience of the type of work involved, and that the project should be reported on by this sub-committee. It was not anticipated that the Board would have to sit very often; these big projects do not come up frequently. It was also contemplated that the services of the Board would be available to Local Governments who wanted advice on any provincial matter; they would be able to lay it before a sub-committee of the Board. That scheme is now under discussion; we have addressed all Local Governments about it, and they have all agreed to the formation of the Board with the exception of one Government, the reply from which is still awaited. I believe that it will come in during the course of this week.

2720. Was the proposal to make that body responsible for research?—The actual details have not yet been worked out, but I think it will probably eventually become a general co-ordinating body for research in the Provinces.

2721. If a scheme arises which touches the interests of more than one Province, would this body you have been talking about adjudicate as between two Provinces?—Yes; that is to say, it would advise the Government of India on the subject.

2722. It would be a purely advisory body, of course?—Yes. It is now proposed to refer the difficulties which have arisen between Bombay and the Punjab to a sub-committee of this body consisting of 3 Chief Engineers who have no connection whatever with either Province.

2723. Is it proposed to alter the nature of the post held by the officer who is mainly responsible for advising the Government of India?—That is still under discussion. There are two proposals; one is to retain a Consulting Engineer who will be responsible to the Government of India for provincial schemes; the other is to reduce his duties so that he will only be responsible to the Government of India for their own works, Local Governments being left to apply for a sub-committee of the Board when they are in difficulties, want advice or have a new project to send up. The Government of India have a large amount of irrigation work of their own in the North-West Frontier Province, and their Consulting Engineer will in any case have to accept responsibility for this. The Government of India are at present considering whether, if the Board comes into operation, it is necessary to retain a whole-time officer to advise Local Governments.

2724. I suppose you are really never concerned in your present post with the details of irrigation; it is only the bigger schemes that concern you?—Yes. For example, I have just returned from Madras. I was asked to go down there by the Government of Madras, in order to inspect the site of a reservoir which they propose to build. They had selected a site, but for various technical reasons wanted to change it. They have to get the Government of India's approval to the change, and they asked me to go down and see the place so that I should be in a position to advise the Government of India when the question came up.

2725. Who pays the cost of a visit of that sort?—The Government of India.

2726. Is any research being carried on at the moment in matters touching irrigation?—There is a good deal being carried on by the various Provinces.

2727. Are you in touch with that?—Not very much.

2728. At all?—No, except when I happen to be on tour and see what is being done.

2729. You do not consider yourself as responsible for co-ordinating that or for attempting to make available in one Province information gleaned by the experiments of another?—No.

2730. Nothing of that sort?—No, but I think that when the new Board is established it will probably function in that capacity. It is probable that there will be a meeting of the full Board every year to see that research in the various Provinces is not overlapping and generally to settle the programme on which the various Provinces should proceed.

2731. Do you think that at the moment there is either overlapping or lack of intercommunication in these matters?—No, not very much. The main lack is of research as a whole. Very few Provinces are really doing anything serious.

2732. Would you care to express any opinion as to whether a firm decision on matters where there is a conflict of interest between Province and Province is likely to be given by a Board consisting of members of services in various Provinces, as compared with an officer advising the Government of India?—I think so. In the case of an officer advising the Government of India there is always the difficulty that he may belong to one of the two Provinces concerned.

2733. May have belonged, that is?—Yes, and may even have prepared the scheme that is in dispute.

2734. I quite appreciate that. Are you responsible for any other branches of engineering which touch agriculture at any point?—No.

2735. You do not do the hydro-electric work of the Government of India?—No.

2736. Who does that?—The Department of Industries and Labour. We have two sides, the public works side and the industries side; but I think I am correct in saying that hydro-electric development is almost entirely provincialised. I do not think such schemes come to the Government of India at all.

2737. You probably know the history of the control of hydro-electrical development in other federal countries. Do you know a single instance of a country where there is a great potential supply of power and in which no attempt is made to regulate schemes with a view to the future?—No.

2738. *Dr. Hyder*: In answering the Chairman with regard to the effect of the Reforms you mentioned conflicts between Provincial Governments and the Government of India. Were there not conflicts between Provincial Governments and the Government of India in the past as regards irrigation matters?—There have been from time to time.

2739. Since their revenues were entangled (the irrigation revenue went to the Central Government and a portion of the land revenue went to the Provincial Governments) the Provincial Governments tried to swell the land revenue share so as to have an increase in their budget, and put down the share of the Government of India?—That has occurred.

2740. Since the introduction of the Reforms that difficulty has gone?—That has gone, yes.

2741. So what you require now is a scheme of co-ordination as regards irrigation matters?—Yes.

2742. At present is there any research not on the irrigation but on the agricultural side being carried on as regards the requirements of various crops in the matter of water?—Yes; such research is being undertaken in some Provinces, though not to the extent one would like to see. Probably in

Poona you will see the Hadapsar farm where the Bombay Irrigation Branch are growing sugarcane, with various intervals between the waterings, various manures and so on, to see which is actually most beneficial to the crop. I was there ten days ago. They are getting most wonderful results from it.

2743. Is anything of that sort being done in the Punjab as regards wheat?—Not so far as I know.

2744. *Sir Thomas Middleton*: You express the view in answer to the Chairman that not nearly enough research was being done. What type of research had you in mind? Was it the type Dr. Hyder has been asking you about experimental work as regards crops?—Yes.

2745. Had you anything else in view?—Such questions as the reclamation of soil, and the discovery of a remedy for water-logging.

2746. That is what I wanted to get at. Is there any work being done by the Irrigation Department on alkali soils, or is that being done entirely by the Agricultural Department at present?—I think it is being done by the Agricultural Department in all Provinces except Bombay, where I believe the Irrigation Branch has been doing work on it.

(The witness withdrew.)

The Commission then adjourned till 2-30 P.M. on Friday, the 22nd October, 1926, at Poona.

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GLOSSARY

Bakhar Blade harrows.
Batai Payment of rent in kind, by division of produce between landlord and tenant.
Cheetal	..	.. The spotted deer (<i>Cervus axis</i>).
Dal	..	.. Generic term for various pulses.
Deshi	..	.. Native to the country, indigenous.
Durries	..	.. Carpets.
Gowalas	..	.. Milkmen.
Hakim (Vaid)	..	.. A practitioner of one of the Indian systems of medicine.
Jagirdars	..	.. Large holders of land granted on special terms for services rendered.
Jemadars	(Kamdars, Petty officers.	
Maistris).		
Jhuming	..	.. Temporary cultivation in jungle clearings.
Juar	..	.. The large millet (<i>Sorghum vulgare</i>).
Kaerez	..	.. A system of irrigation used where sharp slopes make it possible to bring subsoil water to the surface by horizontal shafts.
Kamdars	(Jemadars, Petty officers.	
Maistris).		
Kapas	..	.. Cotton with cotton seed still adhering.
Kharif	..	.. Summer sown (crops).
Kheddah	..	.. Properly a stockaded trap used for capturing wild elephants. Term is also used of a trap for catching wild animals generally.
Kumri	..	.. Temporary cultivation in jungle clearings.
Lungees	..	.. Turbans.
Maistris	(Kamdars, Petty Officers.	
Jemadars).		
Malguzars	..	.. Lit : Revenue payer. A term applied in the Central Provinces to a co-sharer in a village held in ordinary proprietary tenure.
Nagar	..	.. Plough.
Nala (nullah)	..	.. A water course.
Neem	..	.. Margosa tree (<i>Media azadiracta</i>).
Nilgai	..	.. Blue buck (<i>Boselaphus tragocamelus</i>).
Panchayet	..	.. Literally a Committee of five. Used to describe an association of any number of persons instituted for objects of an administrative or judicial nature.
Patel	..	.. Headman of a village.
Patwari	..	.. Village accountant or registrar.
Rabi	..	.. Winter-sown (crops).
Sambar	..	.. A large kind of deer (<i>Cervus unicolor</i>).
Sanad	..	.. A charter. A certificate of honour.
Sir	..	.. The "home farm" of a cultivator.
Taccavi	..	.. Advances made by Government to cultivators for agricultural purposes.
Tahsil	..	.. The Revenue sub-division of a district.
Tahsildar	..	.. The subordinate officer who is in charge of such a district.
Taungya	..	.. Temporary cultivation in jungle clearings.
Thana	..	.. A police station. Also the circle attached to it.
Vaid (Hakim)	..	.. A practitioner of one of the Indian systems of Medicine.

ROYAL COMMISSION
ON
AGRICULTURE IN INDIA

Volume I

Part II

EVIDENCE

OF

Officers serving under the Government of India



CALCUTTA: GOVERNMENT OF INDIA
CENTRAL PUBLICATION BRANCH
1927

INTERIM REPORT

To

THE KING'S MOST EXCELLENT MAJESTY.

May It Please Your Majesty,

We, the Commissioners appointed to examine and report on the present conditions of agricultural and rural economy in British India, and to make recommendations for the improvement of agriculture and to promote the welfare and prosperity of the rural population ; in particular to investigate :—(a) the measures now being taken for the promotion of agricultural and veterinary research experiment, demonstration and education, for the compilation of agricultural statistics, for the introduction of new and better crops and for improvement in agricultural practice, dairy farming and the breeding of stock ; (b) the existing methods of transport and marketing of agricultural produce and stock ; (c) the methods by which agricultural operations are financed and credit afforded to agriculturists ; (d) the main factors affecting rural prosperity and the welfare of the agricultural population ; and to make recommendations ; availing ourselves of Your Majesty's permission to report our proceedings from time to time, desire to submit to Your Majesty certain additional minutes of the evidence which we have taken on the subject of our Inquiry.

All of which we most humbly submit for Your Majesty's most gracious consideration.

(Signed) LINLITHGOW,

Chairman.

(„) H. S. LAWRENCE.

(„) T. H. MIDDLETON.

(„) J. MacKENNA.

(„) H. CALVERT.

(„) N. GANGULEE.

(„) L. K. HYDER.

(„) B. S. KAMAT.

(Signed) J. A. MADAN,

(„) F. W. H. SMITH,

Joint Secretaries.

25th May 1927.

TERMS OF REFERENCE

Generally,

To examine and report on the present conditions of agriculture and rural economy in British India and to make recommendations for the improvement of agriculture and the promotion of the welfare and prosperity of the rural population ;

In particular to investigate—

- (a) the measures now being taken for the promotion of agricultural and veterinary research, experiment, demonstration and education, for the compilation of agricultural statistics, for the introduction of new and better crops and for improvement in agricultural practice, dairy farming and the breeding of stock ;
- (b) the existing methods of transport and marketing of agricultural produce and stock ;
- (c) the methods by which agricultural operations are financed and credit afforded to agriculturists ;
- (d) the main factors affecting rural prosperity and the welfare of the agricultural population ;

and to make recommendations.

It will not be within the scope of the Commission's duties to make recommendations regarding the existing system of landownership and tenancy or of the assessment of land revenue and irrigation charges, or the existing division of functions between the Government of India and the local Governments. But the Commission shall be at liberty to suggest means whereby the activities of the Governments in India may best be co-ordinated and to indicate directions in which the Government of India may usefully supplement the activities of local Governments.

QUESTIONNAIRE**PART I****Question.**

1. Research.
2. Agricultural education.
3. Demonstration and propaganda.
4. Administration.
5. Finance.
6. Agricultural indebtedness.
7. Fragmentation of holdings.

PART II

8. Irrigation.
9. Soils.
10. Fertilisers.
11. Crops.
12. Cultivation.
13. Crop protection.
14. Implements.

PART III

15. Veterinary.
16. Animal husbandry.

PART IV

17. Agricultural industries.
18. Agricultural labour.
19. Forests.
20. Marketing.
21. Tariffs and sea freights.
22. Co-operation.
23. General education.
24. Attracting capital.
25. Welfare of rural population.
26. Statistics.

QUESTIONNAIRE

PART I

1. Research.

(a) Have you suggestions to advance for the better organisation, administration and financing of—

(i) All research affecting the welfare of the agriculturist, including research into the scientific value of the indigenous theory and traditional methods of agriculture,

(ii) Veterinary research ?

(b) If in cases known to you progress is not being made because of the want of skilled workers, or field or laboratory facilities for study or by reason of any other handicaps, please give particulars. [Suggestions of a general kind should be made under (a) ; answers under this heading should relate to specific subjects. The purpose is to secure a list of the problems met with by scientific investigators in the course of their work which are being held over because of lack of resources or deficient organisation.]

(c) Can you suggest any particular subject for research not at present being investigated to which attention might usefully be turned ?

2. Agricultural Education.

With reference to any form of agricultural education of which you may have experience, please state your views on the following :—

(i) Is the supply of teachers and institutions sufficient ?

(ii) Is there an urgent need for extension of teaching facilities in any district or districts known to you personally ?

(iii) Should teachers in rural areas be drawn from the agricultural classes ?

(iv) Are the attendances at existing institutions as numerous as you would expect in present circumstances ; if not, state reasons. Can you suggest measures likely to stimulate the demand for instruction ?

(v) What are the main incentives which induce lads to study agriculture ?

(vi) Are pupils mainly drawn from the agricultural classes ?

(vii) Are there any modifications in existing courses of study which appear to be called for ; if so, what are they ?

(viii) What are your views upon (a) nature study ; (b) school plots ; (c) school farms ?

(ix) What are the careers of the majority of students who have studied agriculture ?

(x) How can agriculture be made attractive to middle class youths ?

(xi) Are there recent movements for improving the technical knowledge of students who have studied agriculture ?

- (xii) How can adult education in rural tracts be popularised ?
- (xiii) In suggesting any scheme for better educational facilities in rural areas, please give your views for (a) its administration and (b) its finance.

3. Demonstration and Propaganda.

(a) What are the measures which in your view have been successful in influencing and improving the practice of cultivators ?

(b) Can you make suggestions for increasing the effectiveness of field demonstrations ?

(c) Can you suggest methods whereby cultivators may be induced to adopt expert advice ?

(d) If you are aware of any striking instances of the success or the failure of demonstration and propaganda work, please give particulars and indicate the reasons for success or for failure.

4. Administration.

(a) Do you wish to suggest means towards the better co-ordination of the activities of the Governments in India or to indicate directions in which the Government of India may usefully supplement the activities of the local Governments ?

(b) Is it your opinion that the expert scientific knowledge required in the development of agriculture in the different Provinces could be supplied to a greater extent than is the case at present by increasing the scientific staff of the Government of India ? If so, indicate the types of work which would benefit by pooling the services of experts, and suggest how that work should be controlled.

(c) Are you satisfied from the agricultural standpoint with the services afforded by—

- (i) The Agricultural and Veterinary Services,
- (ii) Railways and steamers,
- (iii) Roads,
- (iv) Meteorological Department,
- (v) Posts, and
- (vi) Telegraphs, including wireless ?

If not, please indicate directions in which you think these Services might be improved or extended.

5. Finance.

(a) What are your views as to the steps that should be taken for the better financing of agricultural operations and for the provision of short and long-term credit to cultivators ?

(b) Do you wish to suggest means whereby cultivators may be induced to make fuller use of the Government system of *taccavi* ?

6. Agricultural Indebtedness.

(a) What in your opinion are :—

- (i) the main causes of borrowing,
- (ii) the sources of credit, and
- (iii) the reasons preventing repayment.

(b) What measures in your opinion are necessary for lightening agriculture's burden of debt? For example, should special measures be taken to deal with rural insolvency, to enforce the application of the Usurious Loans Act, or to facilitate the redemption of mortgages?

(c) Should measures be taken to restrict or control the credit of cultivators such as limiting the right of mortgage and sale? Should non-terminable mortgages be prohibited?

7. Fragmentation of Holdings.

(a) Do you wish to suggest means for reducing the loss in agricultural efficiency attendant upon the excessive subdivision of holdings?

(b) What are the obstacles in the way of consolidation and how can they be overcome?

(c) Do you consider legislation to be necessary to deal with minors, widows with life interest, persons legally incapable, alienation and dissentients, and to keep disputes out of the courts?

PART II

8. Irrigation.

(a) Name any district or districts in which you advocate the adoption of new irrigation schemes, or suggest extensions or improvements in the existing systems or methods of irrigation by—

- (i) Perennial and non-perennial canals,
- (ii) Tanks and ponds,
- (iii) Wells.

What are the obstacles in your district or Province to the extension of irrigation by each of the above methods?

(b) Are you satisfied with the existing methods of distributing canal water to cultivators? Describe the methods that have been employed to prevent wastage of water by evaporation and by absorption in the soil. What form of outlet for distribution to cultivators at the tail end do you regard as the most equitable and economical? Have these methods and devices been successful, or do you wish to suggest improvements?

(N.B.—Irrigation charges are *not* within the terms of reference of the Commission, and should not be commented upon.)

9. Soils.

(a) Have you suggestions to make—

- (i) for the improvement of soils, whether by drainage or other means, not dealt with under other headings in this questionnaire.
- (ii) for the reclamation of Alkali (Usar) or other uncultivable land,
- (iii) for the prevention of the erosion of the surface soil by flood water?

(b) Can you give instances of soils known to you which, within your recollection, have—

- (i) undergone marked improvement,
- (ii) suffered marked deterioration?

If so, please give full particulars.

(c) What measures should Government take to encourage the reclamation of areas of cultivable land which have gone out of cultivation ?

10. Fertilisers.

(a) In your opinion, could greater use be profitably made of natural manures or artificial fertilisers ? If so, please indicate the directions in which you think improvement possible.

(b) Can you suggest measures to prevent the fraudulent adulteration of fertilisers ?

(c) What methods would you employ to popularise new and improved fertilisers ?

(d) Mention any localities known to you in which a considerable increase in the use of manures has recently taken place.

(e) Has effect of manuring with phosphates, nitrates, sulphate of ammonia, and potash manures been sufficiently investigated ? If so, what is the result of such investigation ?

(f) What methods would you employ to discourage the practice of using cowdung as fuel ?

11. Crops.

(a) Please give your views on—

(i) the improvement of existing crops,

(ii) the introduction of new crops including fodder crops,

(iii) the distribution of seeds,

(iv) the prevention of damage by wild animals.

(b) Can you suggest any heavy yielding food crops in replacement of the present crops ?

(c) Any successful efforts in improving crops or substituting more profitable crops which have come under your own observation should be mentioned.

12. Cultivation.

Can you suggest improvements in—

(i) the existing system of tillage, or

(ii) the customary rotations or mixtures of the more important crops ?

13. Crop Protection, Internal and External.

Please give your views on—

(i) The efficacy and sufficiency of existing measures for protection of crops from external infection, pests and diseases.

(ii) The desirability of adopting internal measures against infection.

14. Implements.

(a) Have you any suggestion for the improvement of existing, or the introduction of new, agricultural implements and machinery ?

(b) What steps do you think may usefully be taken to hasten the adoption by the cultivator of improved implements ?

(c) Are there any difficulties which manufacturers have to contend with in the production of agricultural implements or their distribution for sale throughout the country? If so, can you suggest means by which these difficulties may be removed?

PART III

15. Veterinary.

(a) Should the Civil Veterinary Department be under the Director of Agriculture or should it be independent?

(b) (i) Are dispensaries under the control of Local (District) Boards? Does this system work well?

(ii) Is the need for expansion being adequately met?

(iii) Would you advocate the transfer of control to Provincial authority?

(c) (i) Do agriculturists make full use of the veterinary dispensaries? If not, can you suggest improvements to remedy this?

(ii) Is full use made of touring dispensaries?

(d) What are the obstacles met with in dealing with contagious diseases? Do you advocate legislation dealing with notification, segregation, disposal of diseased carcasses, compulsory inoculation of contacts and prohibition of the movement of animals exposed to infection? Failing legislation, can you suggest other means of improving existing conditions?

(e) Is there any difficulty in securing sufficient serum to meet the demand?

(f) What are the obstacles in the way of popularising preventive inoculation? Is any fee charged, and, if so, does this act as a deterrent?

(g) Do you consider that the provision of further facilities for research into animal disease is desirable?

If so, do you advocate that such further facilities should take the form of—

(i) an extension of the Muktesar Institute, or

(ii) the setting up, or extension of, Provincial Veterinary Research Institutions?

(h) Do you recommend that special investigations should be conducted by—

(i) officers of the Muktesar Institute, or

(ii) research officers in the Provinces?

(i) Do you recommend the appointment of a Superior Veterinary Officer with the Government of India? What advantages do you expect would result from such an appointment?

16. Animal Husbandry.

(a) Do you wish to make suggestions for—

(i) improving the breeds of livestock,

(ii) the betterment of the dairying industry,

(iii) improving existing practice in animal husbandry?

(b) Comment on the following as causes of injury to cattle in your district—

- (i) Overstocking of common pastures,
- (ii) Absence of enclosed pastures, such as grass borders in tilled fields,
- (iii) Insufficiency of dry fodder such as the straw of cereals or the stems and leaves of pulses,
- (iv) Absence of green fodders in dry seasons,
- (v) Absence of mineral constituents in fodder and feeding stuffs.

(c) Please mention the months of the year in which fodder shortage is most marked in your district. For how many weeks does scarcity of fodder usually exist? After this period of scarcity ends how many weeks elapse before young growing cattle begin to thrive?

(d) Can you suggest any practicable methods of improving or supplementing the fodder supply that would be applicable to your district?

(e) How can landowners be induced to take a keener practical interest in these matters?

PART IV

17. Agricultural Industries.

(a) Can you give any estimate of the number of days of work done by an average cultivator on his holding during the year? What does he do in the slack season?

(b) Can you suggest means for encouraging the adoption of subsidiary industries? Can you suggest any new subsidiary industries to occupy the spare time of the family which could be established with Government aid?

(c) What are the obstacles in the way of expansion of such industries as beekeeping, poultry rearing, fruit growing, sericulture, pisciculture, lac culture, rope making, basket making, etc.?

(d) Do you think that Government should do more to establish industries connected with the preparation of agricultural produce for consumption, such as oil pressing, sugar making, cotton ginning, rice hulling, utilisation of wheat straw for card-board, utilisation of cotton seed for felt, fodder, oil and fuel, utilisation of rice straw for paper, etc.?

(e) Could subsidiary employment be found by encouraging industrial concerns to move to rural areas? Can you suggest methods?

(f) Do you recommend a more intensive study of each rural industry in its technical, commercial and financial aspects, with a view to, among other things, introduction of improved tools and appliances?

(g) Can you suggest any other measures which might lead to greater rural employment?

(h) Can you suggest means whereby the people could be induced to devote their spare time to improving the health conditions of their own environment?

18. Agricultural Labour.

(a) What measures, if any, should be taken to attract agricultural labour from areas in which there is a surplus to—

(i) areas under cultivation in which there is a shortage of such labour ?
and

(ii) areas in which large tracts of cultivable land remain uncultivated ?

Please distinguish between suggestions designed to relieve seasonal unemployment and proposals for the permanent migration of agricultural population.

(b) If there is any shortage of agricultural labour in your Province, what are the causes thereof and how could they be removed ?

(c) Can you suggest measures designed to facilitate the occupation and development, by surplus agricultural labour, of areas not at present under cultivation ?

19. Forests.

(a) Do you consider that forest lands as such are at present being put to their fullest use for agricultural purposes ? For instance, are grazing facilities granted to the extent compatible with the proper preservation of forest areas ? If not, state the changes or developments in current practice which you consider advisable.

(b) Can you suggest means whereby the supply of firewood and fodder in rural areas may be increased ?

(c) Has deterioration of forests led to soil erosion ? What remedies would you suggest for erosion and damage from floods ?

(d) Can you indicate any methods by which supply of moisture in the soil, the rainfall and supply of canal water can be increased and regulated by afforestation or by the increased protection of forests so as to benefit agriculture ? Would the same methods be useful in preventing the destruction by erosion of agricultural land ?

(e) Is there an opening for schemes of afforestation in the neighbourhood of villages ?

(f) Are forests suffering deterioration from excessive grazing ? Is soil erosion being thereby facilitated ? Suggest remedies.

20. Marketing.

(a) Do you consider existing market facilities to be satisfactory ? Please specify and criticise the markets to which you refer, and make suggestions for their improvement.

(b) Are you satisfied with the existing system of marketing and distribution ? If not, please indicate the produce to which you refer and describe and criticise in detail the channels of marketing and distribution from the producer to the consumer in India (or exporter in the case of produce exported overseas). State the services rendered by each intermediary and whether such intermediary acts in the capacity of merchant or commission agent, and comment upon the efficiency of these services and the margins upon which such intermediaries operate. Please describe

the method by which each transaction is financed, or in the case of barter, by which an exchange is effected.

(c) Do you wish to suggest steps whereby the quality, purity, grading or packing of agricultural produce may be improved, distinguishing where possible between produce destined for—

(i) Indian markets ?

(ii) Export markets ?

(d) Do you think that more effective steps might be taken to place at the disposal of cultivators, merchants and traders information as to market conditions, whether Indian or overseas ; crop returns ; complaints as to Indian produce from wheresoever originating ; and agricultural and marketing news in general ?

21. Tariffs and Sea Freights.

Do existing (a) customs duties, both import and export, and (b) sea freights adversely affect the prosperity of the Indian cultivator ? If so, have you any recommendations to make ?

22. Co-operation.

(a) What steps do you think should be taken to encourage the growth of the co-operative movement—

(i) by Government,

(ii) by non-official agencies ?

(b) Have you any observations to make upon—

(i) Credit societies ;

(ii) Purchase societies ;

(iii) Societies formed for the sale of produce or stock ;

(iv) Societies for effecting improvements—*e.g.*, the digging of wells and the construction of bunds, walls and fences, or the planting of hedges ;

(v) Societies formed for the aggregation of fragmented holdings and their redistribution in plots of reasonable size ;

(vi) Societies for the co-operative use of agricultural machinery ;

(vii) Societies for joint farming ;

(viii) Cattle breeding societies ;

(ix) Societies formed for any purpose connected with agriculture or with the betterment of village life, but not specified above ?

(c) Where co-operative schemes for joint improvement, such as co-operative irrigation or co-operative fencing or a co-operative consolidation of holdings scheme, cannot be given effect to owing to the unwillingness of a small minority to join, do you think legislation should be introduced in order to compel such persons to join for the common benefit of all ?

(d) Do you consider that those societies of which you have personal knowledge have, in the main, achieved their object ?

23. General Education.

(a) Do you wish to make observations upon existing systems of education in their bearing upon the agricultural efficiency of the people? If you make suggestions, please distinguish, as far as possible, between—

- (i) Higher or collegiate,
- (ii) Middle school, and
- (iii) Elementary school education.

(b) (i) Can you suggest any methods whereby rural education may improve the ability and culture of agriculturists of all grades while retaining their interest in the land?

(ii) What is your experience of compulsory education in rural areas?

(iii) What is the explanation of the small proportion of boys in rural primary schools who pass through the fourth class?

24. Attracting Capital.

(a) What steps are necessary in order to induce a larger number of men of capital and enterprise to take to agriculture?

(b) What are the factors tending to discourage owners of agricultural land from carrying out improvements?

25. Welfare of Rural Population.

(a) Outside the subjects enumerated above, have you any suggestions to offer for improving hygiene in rural areas and for the promotion of the general well-being and prosperity of the rural population?

(b) Are you, for instance, in favour of Government conducting economic surveys in typical villages with a view to ascertaining the economic position of the cultivators? If so, what, in your opinion, should be the scope and methods of such enquiries?

(c) If you have carried out anything in the nature of such intensive enquiry, please state the broad conclusions which you reached.

26. Statistics.

(a) Do you wish to make suggestions for the extension or improvement of the existing methods of—

- (i) ascertaining areas under cultivation and crops;
- (ii) estimating the yield of agricultural produce;
- (iii) enumerating livestock and implements;
- (iv) collecting information on land tenure, the incidence of land revenue and the size of the agricultural population;
- (v) arranging and publishing agricultural statistics?

(b) Have you any other suggestions to make under this heading?

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MINUTES OF EVIDENCE

TAKEN BEFORE THE

ROYAL COMMISSION ON AGRICULTURE.

Tuesday, November 9th, 1926.

BANGALORE.

Present:

The MARQUESS OF LINLITHGOW, D.L. (*Chairman*).

Sir HENRY STAVELEY LAWRENCE,
K.C.S.I., I.C.S.
Sir THOMAS MIDDLETON, K.B.E.,
C.B.
Rai Bahadur Sir GANGA RAM, Kt.,
C.I.E., M.V.O.

Sir JAMES MACKENNA, Kt., C.I.E.,
I.C.S.
Mr. H. CALVERT, C.I.E., I.C.S.
Professor N. GANGULEE.
Dr. L. K. HYDER.
Mr. B. S. KAMAT.

Mr. J. A. MADAN, I.C.S. }
Mr. F. W. H. SMITH. } (*Joint Secretaries.*)

Mr. W. SMITH, Imperial Dairy Expert, Bangalore.

Memorandum on the Animal Husbandry Section, Bangalore.

In submitting memoranda to a Commission some of the members of which are not intimately acquainted with Indian agricultural conditions, it is necessary in the first place to briefly state the present position of the cattle-breeding and dairy industry and its importance from the point of view of the agricultural well-being of the country.

This Section of the Imperial Agricultural Department which is under my control deals primarily with dairying and dairying means cattle-breeding and connotes the whole cattle industry. India, speaking in a general sense, does not rear cattle for beef and consequently milch cattle and plough bullocks are her cattle requirements, and as it takes a cow to produce a bullock and as the country cannot afford to have any cows which are not milk-producing cows, it follows that the dairy industry includes the whole cattle-breeding industry; the two are one and indivisible. The development of the dairy and cattle-breeding industry is by a long way the most important agricultural

Mr. W. Smith

problem in India. The Indian agriculturist has more of his money invested in cattle than in any other capital form. It is more important than the growing of wheat or cotton or rice or any crop; it is as important and universal as the growing of all crops. India is a country of small fragmented holdings and the cultivation of the land cannot be done by tractors or by horses or mules, it can only be done so far as traction is concerned by the agency of the bullock so that the cultivation of every crop depends upon the efficiency of the working bullock, not only so but the primary transport of all crops produced must be done by the bullock. There is no doubt whatever but that the use of improved implements and machines for the cultivation and harvesting of crops has been and is being seriously retarded, because the cultivator does not possess a bullock of sufficient strength, size, weight or speed to work these improved machines and implements. The health and physical welfare of the whole of the people of India depends upon a plentiful, pure and clean supply of dairy produce. Great masses of the people of this country are vegetarians and I think it is admitted nowadays that in no form of vegetable fats can that particular growth principle be found which is so necessary for the proper development of the young. This growth element can only be found in animal fat, and as our people in the main do not eat flesh the only kind of animal fat they can use to attain the growth vitamins is milk fat. The milk-supply of India to-day is indescribably bad; it is filthy, expensive and scarce. No wonder the infant mortality in some of our large cities equals 666 per 1,000 infants from birth to one year old.

The cattle-breeding and dairy industry is also important because in its present state it imposes a colossal yearly drain on the wealth of the country. In India including Indian States there are at the present time 180,000,000 of all kinds of bovine stock, the total value of which may be taken as some nine hundred crores (nine thousand millions) of rupees. The majority of the people of India are Hindus and to the Hindus it is wrong to take animal life, not only so but it is a doubly heinous offence to take the life of any member of the ox tribe. The cow is sacred and is venerated by the Hindus from Peshawar to Tuticorin. Broadly speaking, the cattle-breeding industry in India is in the hands of ignorant jungly tribes who have no scientific knowledge of the principles of breeding or the practice of cattle-rearing, and consequently millions of absolutely useless scrub cattle are born in the country every year. These animals are so poor that they cannot do any work nor do the females yield any milk, yet having been born they cannot owing to the Hindu sentiment be killed and the country must keep them until they die. These animals not only yield the country no return outside of the value of their hide and bones when they die, but they consume the food which the working and milk-producing animal ought to get and as the males are not castrated they perpetuate their degenerate species all over the land. In any other country in the world these animals would be killed and utilised for food at the end of their third monsoon when they had sufficient flesh on their bones to pay for what they had eaten. Here they have a brief period of plentiful feeding each monsoon, followed by eight or more months of semi-starvation until they die, and their bones and hides are sold by the sweeper caste. A writer in the "*Madras Mail*" of 21st April, 1926, calculates that the loss to this country due to the upkeep of these useless cattle is not less than sixty-one crores and twenty lacs (six hundred and twelve millions) of rupees per annum. I cannot vouch for the correctness of this figure, but the drain on the wealth of the country due to this state of affairs is truly colossal and the foregoing shows the existing deplorable state of the cattle-breeding and dairy industry. It will be seen then that not only is the development of the cattle-dairy industry the most important problem facing Indian agriculture, but owing to the Hindu sentiment "thou shalt not kill the cow" it is the most difficult agricultural problem in India. The improvement of the quality of Indian crops or methods of Indian cultivation, and the education of the Indian cultivator are as easy here as they are in any other part of the world, but the cattle problem is hedged around by Hindu sentiment, and by reason of this sentiment it is not only the loss through the working and milking of inefficient cattle that India has to face, she has to

foot a larger bill in supporting the altogether useless cattle which cannot be killed owing to the sentiments of her people. There is only one solution of the problem. Hindu sentiment will not change for a long time to come and the cattle-breeding and dairy industry must be raised to that high level of efficiency when the breeders of cattle will only permit efficient and suitable animals to be born and those only in such numbers as the country requires. Now not only is the cattle-breeding and dairy question the most important and the most difficult problem facing the Indian agriculturist, but it is the most universal. It must be handled from an All-India point of view. It cannot adequately be dealt with by Provinces or States, because the cattle-breeding policy and practice of one Province or State may largely affect the agricultural efficiency of another Province or State. Bengal, for instance, breeds comparatively few cattle and those she does breed are of poor quality. The Bengali cultivator to a large extent depends upon the breeders of Bihar and Orissa to supply him with his work cattle. Then again both Rangoon and Calcutta depend almost entirely on the Punjab for the supply of their milch cattle and Bombay draws its milking cattle from the Punjab and Sind. Not only is the question universal from this point of view, but over the whole country every caste, creed, and class uses milk and milk products freely in their dietary and cultivators of every part of India look for an efficient field ox. It would seem, therefore, that this question which is so vital to the agricultural and general progress of the country would receive very special attention at the hands of the Central Government. That it has not done so can be easily proved. In fact this great problem has been all along treated as the Cinderella of Imperial Agriculture as the following brief resume of facts will show.

In response to recommendations made by the Board of Agriculture at their meetings at Coimbatore in 1913 and Pusa in 1916 the Government of India in May 1920 appointed an Imperial Dairy Expert, and in July 1921 the appointment of a Physiological Chemist was made to carry out research work in connection with problems of animal nutrition. The recommendation made by the Board of Agriculture at the two meetings before referred to, besides the appointment of an Imperial Dairy Expert and a Physiological Chemist, recommended the establishment of dairy schools and of breeding farms on a moderate scale; but although I was appointed to the post of Imperial Dairy Expert in May, 1920, Government did not provide me with either money or facilities of any sort whatever to carry out any educational or research work until July 1923. In 1922, with the enthusiastic support of the Agricultural Adviser to Government, I requested Government to hand over to this department the thirty-four Military dairy farms in India so that they could be utilised as training centres, breeding farms and research stations. On the recommendation of the Incheape Committee two of these farms with a small hill farm were handed over for educational and research purposes instead of thirty four asked for, and the farms handed over were only given on the understanding that they were to be self-supporting, or in other words that this department would provide that education so badly wanted, and carry out as well much needed research work without a penny of cost to the State.

The farms before referred to, which were taken over from the Military Department in 1923, are situated at Karnal in the Punjab and Bangalore or Mysore State with a branch of Bangalore farm at Wellington in the Nilgiri Hills. Then, in October, 1925, this department took over the Military creamery at Anand in Gujarat to be used, as a dairy factory school. The staff employed by the Military Department on the Bangalore, Wellington and Karnal farms were taken over with the farms. The laboratories of the Physiological Chemist to Government were moved from Pusa and the Bangalore farm was converted into a central teaching and research institution now known as the Imperial Institute of Animal Husbandry and Dairying. Three classes of pupils are taken on there for training from all parts of India, viz.:—

- (1) Post-graduate pupils for advanced instruction in animal nutrition, animal husbandry and dairying.

Mr. W. Smith.

- (2) Pupils for the Indian dairy diploma granted by the Institute (2 years' course).
- (3) Short course students for special instruction in specific subjects connected with animal husbandry or dairying.

The Karnal farm is utilised for the instruction of all three of the above classes of pupils and is primarily a cattle-breeding research station where three separate herds of pure Indian cattle have been established and which are being developed on pure lines.

The Wellington farm is merely a branch of Bangalore kept up to provide the British garrison in that station with pure milk and butter.

The Anand Creamery was acquired in order to provide factory instruction and to carry out research work in connection with the manufacture of *ghi*, butter, condensed milk, dried milk and factory milk products generally. I have just learned that Government may close down this factory because it is not paying. This creamery is situated in the one district in India where milk is available in large quantities, and where butter and casein are manufactured for home consumption and export. This Section cannot possibly carry out its work without one dairy factory of this kind. Indian factory methods of butter, *ghi*, and casein manufacture are crude, uneconomical and dirty. India imports large quantities of condensed milk, dried milk, and milk products of various kinds, all of which should be made in the country. Research and experiment of this kind is more necessary in India at the present moment than any other class of dairy work. In fact it is absolutely vital to India. It lies at the root of the whole cattle problem. It is no use improving the yield of the Indian cow or buffalo unless along with this improvement a market is provided for the milk of these animals. This can only be done in the rural areas by developing the manufacture of milk products. Nothing whatever is known about the scientific manufacture of any class of modern milk product from the milk of the buffalo. Present methods are crude, filthy and wasteful. The closing down of the research creamery at Anand would be a national disaster. The most urgent and pressing dairy problem in India to-day is the utilisation of by-products in the manufacture of *ghi*, and so far neither the Imperial nor any Provincial Government has touched the problem. This Section was preparing to do so at Anand.

So far outside of the actual staffs required to work the farms and formerly employed by the Military dairies no extra staff for educational and research work has been provided for this Section other than that a general assistant to the Imperial Dairy Expert was appointed in December 1925. Consequently the amount of research work undertaken has not been at all commensurate with the needs of the industry. The demand for dairy and cattle-breeding education at all the farms and the dairy factory has since the commencement of the concerns been far more than could be undertaken. Research work in the development of our two herds of Indian cows and the Indian buffalo herd at Karnal (the former on dual purpose lines, milk and draught, and the latter for milk production) is being carried out. Owing to paucity of staff and want of funds this Section has not yet been able to touch the fringe of the many pressing problems facing the cattle-breeding and dairy industry in its national aspect, consequently practically no results of research work done by this Section have so far been made available for the advancement of Indian agriculture.

Since my appointment as Imperial Dairy Expert in 1920 this Section has been in continual close touch with all the Provincial Departments of Agriculture, with the Corporations of the large cities and with most of the Indian States, *pinjrapole* societies, etc., and technical advice with building plans, machinery specification, etc., has issued from my office in a continuous stream since its inspection. The demand from all over the country for this class of information continues to increase and the supply of technical advice occupies a large part of my time and that of my assistant. I maintain a practically continuous correspondence with all the Directors of Agriculture in India, with

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many of the Co-operative Departments and with the cattle-breeding experts. My office is freely consulted by all the Departments of Agriculture in the country on matters connected with cattle-breeding and dairying, and in this respect I consider we have done, and are doing good work.

The training of post-graduate students at Karnal, Anand and Bangalore for the highest posts of the department is undertaken by this Section in co-operation with the Physiological Chemist to Government; and in my opinion this training could be improved by the provision of a scientific research staff at Bangalore and Karnal farms, but especially at the Anand Creamery under whom the post-graduate men could work.

I consider that our present facilities for giving short courses of study to persons connected with the cattle-breeding and dairying industry are good, but they would be improved by the addition of the scientific research staff above referred to.

The work of this Section has been carried on at all times in the most active and pleasant co-operation with all the officers of the Imperial Agricultural Department and as before stated with the Directors of Agriculture and expert cattle-breeding dairy officers of all the Agricultural and Veterinary Departments. This Section by reason of the class of work done has been more particularly in touch with the Agricultural and Bacteriological Sections at Pusa and in daily co-operation with the Physiological Chemist at Bangalore. On various occasions the Section has supplied detailed information regarding the position of the dairy industry in India to the International Institute of Agriculture in Rome.

Replies to the Questionnaire.

Before dealing with those specific questions which pertain to cattle-breeding and dairying, I desire to make a few remarks regarding Question I (b), Research.

QUESTION 1 (b).—The section of the Imperial Department of Agriculture under my control comprises the following units in addition to the office of the Imperial Dairy Expert:—

The Imperial Institute of Animal Husbandry and Dairying, Bangalore.

The Imperial Government Dairy Farm at Wellington.

The Imperial Government Cattle Breeding Farm at Karnal, Punjab.

The Imperial Government Creamery at Anand, Gujarat.

The office of the Imperial Dairy Expert was opened in May 1920, and the three first mentioned farms were taken over from the Military in 1923. The Anand Creamery was taken over in 1925.

All of these institutions are utilised as far as circumstances permit as teaching or research centres. The Imperial Institute of Animal Husbandry and Dairying grants a diploma in practical dairy farm management. The course for this diploma is a two years one, and the teaching for this diploma, in order to make it as varied and practical as possible, is given at Bangalore, Karnal and Anand Creamery. The number of students now under training for this diploma is 23 this being the maximum number which the existing hostel accommodation could provide for, but the actual number of suitable men who applied for tuition in the class now undergoing instruction was 69. In addition to the diploma students all the farms under this section and the creamery take men for short technical courses, as well as post-graduate students for special research work. During the past two years 74 short course students and 7 post-graduate students have taken courses.

The laboratory, cattle sheds and stores of the Physiological Chemist to Government are situated in the farm yard of the Bangalore Institute, and the scientific staff of this officer has up to the present very kindly undertaken the teaching of students in dairy chemistry, food analysis, and animal nutrition. I regard the animal nutrition work of the Physiological Chemist as of vital importance to the agriculture of India, and it has been the aim of this office to co-operate with him in every possible direction, but if the activities of this officer are to expand in the future as they have in the past the day is not far distant when there will not be room at the Bangalore farm for the Institute and the Physiological Chemist, and I am of opinion that in view of the magnitude and national importance of animal nutrition research a separate farm with herd, lands and scientific laboratories should be given to the Physiological Chemist, and that the existing laboratories and buildings now occupied by him at Bangalore be handed over to the dairy institute and utilised for teaching and research purposes on cattle-breeding and dairy problems. This eventuality was foreseen in 1924, as in that year this office suggested to the Government of India that the Hosur Remount Depot, now the Madras Government Cattle Farm, then the property of the Imperial Government which was to be abandoned by Military Remount Department, should be handed over to the Bangalore Institute in order to permit of future extensions and to enable the Bangalore farm to grow its own fodder requirements. Up to the present this Section has been able to do very little in the direction of research work in connection with dairy problems. Experimental cattle-breeding work is being done at all three farms, but owing to lack of staff and funds, and to the fact that in the initial stages the energies of this office were concentrated upon the organisation of the farms as educational centres, little or nothing has been done to solve the many pressing problems affecting the dairying and cattle-breeding industry. The time has now come when this work should be undertaken on a purely national scale. In this connection please see my remarks on page 10 of this note regarding Anand Creamery. On the purely

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dairy side of the work the factory problems there referred to are most pressing. The following specific problems, I consider, call for immediate investigation :—

- (1) The manufacture, storage and transport of *ghi*.
- (2) The manufacture of condensed milk from the milk of the buffalo.
- (2) The utilisation of the skim or butter milk a by-product from *ghi* manufacture, connoting the manufacture of dried milk, casein, milk sugar, skim milk cheese.
- (4) The manufacture, storage and transport of butter under tropical conditions.
- (5) Standardisation of Indian dairy products as regards purity.
- (6) Testing and recording of the quality, *i.e.* chemical composition, of the milk of all the different well-known breeds of Indian cows and buffaloes.
- (7) Transport of fresh milk for long distances in India including transport methods.

QUESTION 16 (a).—For two reasons it is vitally important that something should be done on a national scale to improve the breeds of cattle in India. Firstly the quality of the cattle of India grows worse from year to year. The introduction of modern and more efficient cultivating, seeding and harvesting machinery is being retarded, and the growing of every class of crop is adversely affected through the inefficiency of the plough bullock. Not only so but the general health and physical well-being of the whole community, rural as well as urban, is detrimentally influenced through the lack of a plentiful, cheap and safe supply of dairy produce, due to the inefficiency of the Indian milch cow.

Secondly owing to the Hindu sentiment regarding the killing of cattle and to the ignorance, apathy and want of skill on the part of the cattle breeders, this country is called upon to support continually millions of cattle which, from birth to death, are quite useless. They are not good enough to do any work or produce any milk. It costs the country anything from Rs. 15 to Rs. 30 per head per year to keep them. Their average life may be taken as 6 years and at the end of that time they die and the country gets Rs. 12 to Rs. 15 per head for their skin, horns and bones. Not only so but these perfectly useless animals eat up the fodder which should go to the fairly efficient workers and milkers, and thereby impair their utility. Again in the districts which support these animals, castration is not generally practised and the miserable half starved males roam about perpetuating their species and further reducing the quality of the cattle of the country. It is difficult to estimate how much this drain on the wealth of India amounts to. That it reaches a colossal figure yearly is certain.

Cattle-breeding and dairying in India, I regard as one and indivisible. This is mainly a vegetarian country and beef has no value, nor will the people of India work the female of the ox tribe in the plough or the cart, so that what the country wants is efficient draught bullocks and profitable milking cows. It being particularly borne in mind that almost every animal born must be permitted to live and must be fed. We cannot destroy the poor field worker nor the worthless cow. The country is saddled with whatever its cows give birth to, and it cannot afford to keep a cow just good enough to be the dam of future generations. In order that the cow shall pay for her keep she must, seeing she is prevented by custom from doing field work, give sufficient milk to rear her calf and in addition as much as will be equal in value to the cost of her maintenance. For India therefore we require for all districts a suitable type of dual purpose animal, the male being efficient as a field worker and the female as a milker. It has, I think, been demonstrated now that such cattle are obtainable and that many of the best breeds we have in India, possess these dual qualities.

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If the foregoing accurately describes the position then the solution lies in:—

- (1) The development of pedigree herds on dual purpose lines, suitable for each district.
- (2) The careful distribution and supervision of bulls from these herds.
- (3) The development simultaneously with (1) and (2) of technical dairying and especially the co-operative handling and sale of milk, production and sale of *ghi*, and manufacture and sale of milk products, all as village industries.
- (4) The dissemination of knowledge regarding the breeding, rearing and feeding of cattle and the growing and conservation of fodder crops for their maintenance.
- (5) The extension of the Civil Veterinary Department to give better service in the detection, prevention and cure of animal diseases.

With regard to (1) the formation of pedigree herds. My experience in India follows that of the world of animal breeders in general that successful breeding cannot be done with a mongrel sire. There was probably a day in the history of India when the dedicated or Brahmini bulls, used mainly for breeding purposes throughout the country were the best that could be procured. At that time huge more or less isolated ranching areas were available for cattle-breeding where there was little or no admixture with different types of cattle from other parts of the country, but the spread of irrigation canals, the reservation of forests, and the general increase of the cultivated area has driven the cattle-breeding clans into the rough jungle tracts, and the improvement of roads, the establishment of railways and the general advance in transport and means of communications, has so mixed up the one time breeds of cattle in India, that most of the bulls now used as sires can be truly classed as mongrels. Added to this is the fact that in India as in other parts of the world, religious fervency has declined and the Brahmin, who now dedicates a bull on the birth of his son, is often more concerned in obtaining an animal at a moderate price than with getting the best possible breeding bull. In this connection please see copy of this office letter No. 2925-A., dated 6th January 1926 (Appendix I), addressed to the All-India Cow Protection Society. The pedigree herds of cattle in Great Britain, which have formed the foundation stock of more than half the cattle in the world's temperate zones, were built up by private individuals and the various now well-known breeds were evolved or created at the expense of private enterprise, and it has been stated that the same procedure must be followed in India. I give it as my opinion that this cannot be done here and if India is to wait until her private cattle owners, at their own expense, build up pedigree breeds of cattle, she will wait until the crack of doom. The conditions are very different. In Europe the commercial value of beef enabled the far-sighted breeder to dispose off his rejections, which in the initial stages must be numerous, at an economic figure and he could knock on the head at birth any very weedy calves. In India the flesh of cattle has little or no value as food and if it had, no self-respecting Hindu breeder would sell his cattle to a butcher nor will he kill worthless calves. The building up of pedigree herds in India must be a losing business for many years to come and therefore it can only be done by the State. No amount of propaganda or official persuasion will induce Indian landed proprietors, cultivators or business men to undertake this work because although it will in time yield a handsome return to the country in the increase of wealth due to enhanced cattle efficiency yet, the loss or cost to the person, company or State which does this pioneer work will be heavy. Government cattle-breeding farms in India cannot be expected to pay their way for many years to come and this fact has been emphasised by the Board of Agriculture.

Regarding the second recommendation of this note—the distribution and control of pedigree bulls. This is a work which will require very special attention. It may be done through local boards, village panchayets, co-operative societies or other agencies, and along with this must go an organised

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system for the castration of all unfit males. Bearing in mind the fact that in most parts of India cattle once born cannot be killed or sold for beef, it will be realised how important it is that only the number of cattle actually required by the country should be begotten and only efficient and healthy animals should be brought into world. We have far too many cattle in India. What we want is fewer cattle, but all of them efficient and profitable. The aim of the Agricultural Departments from a breeding point of view should be suitable bull or bulls in every village, properly controlled and supervised. This is not an impossible dream. It has already been done in some parts of the Punjab where owing to the energetic action of the Government of that Province, the decline in the quality of cattle has been stayed.

We are at the parting of the ways in India in regard to this cattle-breeding problem. This country like all other countries at some stage of their development, has reached the point where it can no longer afford to set aside huge areas for breeding cattle on the ranching system, because it now requires these areas to grow food for its people and cotton to clothe them. Owing to want of knowledge on the part of those closely interested in stock breeding, the cattle of the country have got into such a mixed up condition that it is not profitable for the cultivator to breed his own animals. It must therefore be the aim of all interested in agricultural propaganda and progress to demonstrate to the cultivator that he must breed and rear cattle and that if he uses the right breeds and practises the correct methods, cattle-rearing and the growing and conserving of fodder crops for this purpose as a regular part of his agricultural operations will be profitable. There is no use telling the cultivator this. It must be demonstrated to him before his eyes, and it cannot be demonstrated until he can be offered the services of a bull which will be certain under specific condition to produce an efficient field bullock and a profitable milch cow, and it is at this juncture that the third proposal of this note (the development of technical dairying) comes in. It is not merely necessary to enable the cultivator, who must be the breeder of the future, to produce a milk-yielding cow. He must be taught how to economically utilise the milk of this animal. The milk producers of India to-day are steeped in technical ignorance and superstition. The methods of manufacture of *ghi* and the various forms of Indian cheese and partially evaporated milk are filthy and wasteful, so much so that at the flush season of the year in many of the *ghi*-producing tracts the butter milk or by-product from *ghi* manufacture containing all the valuable casein albuminoids and milk sugar is thrown away. Apart from this aspect of the question, India badly requires village industries to provide additional sources of employment and to generally increase the standard of village life. What industries are more suitable for this purpose than the manufacture of *ghi*, country cheese, casein and dried milk, etc., on a small factory scale owned and managed on co-operative principles. With the aim of encouraging this phase of dairy development, I started a class for the instruction of officers of the Co-operative Departments of all the Provincial Governments and Indian States, at the Imperial Institute of Animal Husbandry and Dairying at Bangalore. The first class held in 1925 was attended by some 26 officers from most of the Provinces and principal Indian States. The Government of India authorised this class but in doing so they gave it as their opinion that in giving instruction of this nature the Imperial Department of Agriculture were encouraging on the functions of the Provincial Departments of Agriculture. I attach copy of a letter from the Registrar of Co-operative Societies, Punjab, to the Government of India and a copy of the reply of the Government of India to the same (Appendix II), from which it will be seen that the Government of India expect a recommendation from the Royal Commission on Agriculture regarding this matter and the Royal Commission on Agriculture may consider the advisability of communicating their views to the Government of India at a date earlier than the submission of their full report.

Up to the present none of the agricultural colleges in India has attempted to give instruction in dairy factory work nor has any experimental work been done on the very important problems such as the manufacture of *ghi*,

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casein, or other milk factory products. In October last the dairy section of the Imperial Department of Agriculture took over the disused Military Creamery at Anand in Gujarat, for the purpose of utilising it as an instructional centre for creamery work and for experimental work in connection with dairy factory problems. The working of this creamery has not, owing to severe competition in the fresh butter market and for other reasons, been as profitable commercially as I had hoped and consequently the Government of India, I understand, contemplate closing it down. In this connection I attach copy of a letter addressed to the Agricultural Adviser to Government, on June 16th, 1926 (Appendix III) and with a view to advising the Government of India concerning the retention or otherwise of this creamery, the Royal Commission on Agriculture might consider the advisability of some of its Members visiting this creamery and inspecting the local butter and *ghi* factories in Gujarat, the greatest milk-producing district in India. As an indication of the conditions now prevailing in the Gujarat dairies, I may mention that the Bombay Cattle Commission which consisted of 5 distinguished Indians and 2 Europeans described these places in paragraph 31 of their report published in 1923 as reproduced below:—

“The Committee whilst touring in Gujarat took the opportunity of visiting some of the so called dairies in Ahmedabad where the bulk of the butter and other dairy produce is manufactured for the whole of India. The Committee were surprised to find that this industry is carried out under the most filthy and dirty conditions imaginable. These so called “dairies” are situated in the most insanitary by-lanes of the city. The butter produced under these conditions is sold all over India and a certain amount is exported (even to Great Britain). It is a well-known fact that milk and its products are best medium possible in which injurious bacteria and germs of typhoid, diphtheria, cholera, etc., thrive and in which they are carried and spread over the whole of India. It is essential for the public health that production on honest and scientific lines should be made a financial success, so that the public at large will get a safe and sure supply of milk and its several products.”

Owing to lack of funds and the attempt to obtain commercial results from what are educational and research institutions, no research work has yet been done in connection with such pressing problems as:—

- (a) the manufacture, storage and marketing of *ghi* in large and small quantities;
- (b) the manufacture of casein, condensed milk or dried milk from buffaloes milk;
- (c) manufacture of *panir* (Indian cheese) from skim-milk.

This kind of research work can only be properly carried out at an experimental dairy factory situated in the premier milk-producing area, Gujarat. It is useless to attempt this class of experiment with milk produced by Government cattle fed, housed, and looked after under perfect conditions at the Government owned farms at Bangalore and Karnal. This work must be done on a factory scale with purchased village milk produced under ordinary working conditions and adulterated, as the village producer will insist on adulterating it. Within the last 20 years India has lost the valuable butter export trade to the Far East because of the inferior quality of her butter due to lack of technical knowledge of methods of manufacture. For the same reason the value of Gujarat casein in the world's markets is only half of the French and New Zealand product. The site of the Anand Creamery is most suitable, the land on which the creamery stands is already the property of the Imperial Government, and the closing of this creamery before it has even begun its much needed research work would, I think, (as I have stated in my letter to the Agricultural Adviser to the Government of India) be nothing short of a national calamity. In this instance also, and in view of the urgency of the question, the Royal Commission may consider the advisability of communicating with the Government of India at an early date.

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The cultivator in India knows how to make use of his bullock, but he does not possess the most elementary knowledge of how to make profitable use of the surplus milk from his cows or buffaloes. Along with the improvement of quality of his cow he must be taught how to utilise his milk to the best advantage.

In dealing with the fourth recommendation of this note it is unnecessary to say much. Vigorous propaganda by means of cinema films, lantern slides, lectures and last but not least small demonstration farms, where profitable cattle are employed and where the benefits of mixed farming with stock breeding as an essential part, could be shown in operation.

As regards item five of the recommendations of this note, I regard the work of cattle-breeding, rearing, feeding and management as coming under the sphere of agriculture rather than veterinary operations. There is so much scope for the skilled veterinary officer in the sphere of the prevention and cure of animal diseases that I consider he cannot profitably be asked at this juncture to take up such purely agricultural problems as the breeding and rearing of livestock.

Before dealing with the minor points raised in the Questionnaire, I desire to call attention to the national aspect of this cattle-breeding question and the necessity for some form of central authority for dealing with it. The Board of Agriculture recognising this have at their meetings at Bangalore in 1924 and at Pusa in December 1925 recommended the establishment of a Central Cattle Bureau. This has been commenced with a small clerical staff and the Imperial Dairy Expert as Secretary and it is understood that the Government of India have under consideration the formation of a representative board or committee, as recommended by the Board of Agriculture at their Pusa meeting in 1925, to control the operations of the Central Cattle Bureau. The functions of this Bureau under the control of a Committee represented of all the Provincial Governments and Indian States would be to establish and control herd books, to supervise and authenticate milk records, to keep all Governments and breeders in touch with the cattle-breeding activities of other breeders; and the Bureau, if given sufficient staff and funds, will do a useful and very necessary work in India, but the cattle-breeding dairying problem is so universal to the whole country and so important nationally that I consider some greater degree of central co-ordination and guidance is necessary than can be exercised by the Central Cattle Bureau. It is I think certain that Bengal, by reason of the nature of its soil and climate, will always require new blood for cattle-breeding from other Provinces of India. Calcutta at present procures the whole of its milch cattle from the United Provinces and the Punjab. Bombay is largely dependent for its supply of milch cattle on the Punjab. The Province of Sind supplies milch cattle to many districts in India and Burma, and Rangoon imports cattle regularly from the Punjab and Bihar. Then there is the question of control of the export and import of cattle which must always be in the hands of the Government of India. The time is perhaps not yet ripe for the restriction of the movements of cattle to prevent the spread of disease, but this will come some day and when it does it will have to be controlled by the Central Government. The question of milk standards, standards of purity for *ghi*, butter and other dairy products, should be the same all over the country and generally speaking this cattle-breeding dairying question is so universal, its development so vital to the whole country that if at all possible the Government of India should retain some sort of central control over it. This might best be done by the Central Government giving substantial grants to Provincial Governments for cattle-breeding dairying, conditional on the money being spent on work approved of by the Central Government, or if the control of the Government of India was objected to the central authority might take the form of a central agricultural council representative of all the Provincial Governments and Indian States with small executive committees of experts to deal with each of the special phases of agriculture in the country.

QUESTION 16 (b).—My district is the whole of India and Burma, and consequently in this note I have attempted to deal with the whole question from a

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national as opposed to a provincial point of view. In most cases what remains of the common pastures are overstocked, and they will be so until the cultivator becomes a breeder and until he realises that he can make money by breeding and rearing cattle and growing and conserving fodder for this purpose. He will only be able to do this with some degree of assistance from the State in the direction of:—

- (a) The provision and control of suitable sires.
- (b) Education, by demonstration and otherwise concerning breeding and rearing of cattle and the utilisation and sale of dairy produce.

After all every country in the world which has tackled the improvement of its cattle has employed some system of *State aided* bull provision and distribution. In the more developed countries the premium bull system is in operation to-day. Here we must produce the pedigree bull to commence with as he is not otherwise available. It is the recognised function of every State to provide not only elementary education but technical education for its people. Dairying on village factory lines has greatly added to the wealth of all the most progressive nations of the world, and India cannot afford to refuse technical education on this subject.

Grazing on the cultivated tracts and especially the irrigated tracts in India is a waste of land. What the Americans term "siloin" is the most economical way of feeding cattle, outside of the jungle tracts, in India. This question will only be solved when it can be made profitable for the cultivator to rear cattle and to grow and conserve the necessary fodder for their maintenance. At the same time much could be done all over India by the conservation of the surplus green grasses of the coarser types, during the rains, by means of pit silos. The making of this class of silage is simple, inexpensive and certain in its results. The system, I think, only requires to be demonstrated to make it universal. It is not practised because its value is unknown and no ordinary cultivator will believe it can be done until it is actually demonstrated to him. If in India we only breed sufficient efficient cattle for our requirements, and if by means of silage we conserved the green fodder which is wasted every year by being allowed to run to woody fibre after the rains there would be no shortage of roughage in this country.

The only way in which landowners can be induced to take a keener practical interest in the cattle-dairy industry is by demonstrating to them that the use of pedigree sires and the adoption of modern methods are financially profitable and this cannot be done as explained in this note, until by State assistance pedigree has been created. In most parts of India the scarcest months of the year for fodder-supply are April, May and June.

The question of the mineral contents of fodder can best be answered by Mr. Warth, but it is certain that in many parts of the country the local fodders are deficient in mineral matter.

I desire to bring to the notice of the Royal Commission a disability under which the Indian cattle trade labours in connection with the transport of milch cattle by passenger train. Indian cows are useless as milkers unless their calves accompany them and the railway companies including State railways charge the same amount for the carriage of a newly born calf by passenger train as they do for a full grown cow or bullock. This is a very great hardship, the cow is no use without the calf and consequently the calf if sold apart from the cow has no value. Besides it does not seem fair that the same rate of freight should be charged for a newly born calf weighing 30 lbs. and of no commercial value as for a cow or bullock weighing say 800 lbs. and worth Rs. 250 to Rs. 500.

APPENDIX I.

Letter No. 2925-A., of 1926, dated Bangalore, the 6th January 1926, from W. Smith, Esq., the Imperial Dairy Expert, Bangalore, to the Honorary Secretary, the All-India Cow Conference Association, Calcutta.

I offer the following remarks on the cattle-breeding scheme sent with your letter :—

To my mind every Province in India *requires* good milch cows and efficient working bullock. My experience goes to show that in Madras of all the Indian Provinces, outside of the immediate vicinity of the larger cities, little or no attention is paid to milk production as a factor in selection for breeding, consequently I cannot agree with you that in this Province "good milkers are keenly appreciated." I do not agree that the advent of British rule either upset the course of Indian social life or ignored the cattle-breeding systems of the country.

I agree with Mr. Blackwood's remarks that the Brahmini system of bull distribution so long as it was the result of strong religious fervour served a useful purpose, but these days I fear religious feeling is not as strong as it was. I have on more than one occasion sold a bull to a Hindu to be dedicated, branded and turned loose and the buyer was by no means anxious to secure the best bull available but he was most anxious to buy the cheapest bull he could get, and in this decline of religious fervour, common to the whole world, these days, lies the reason for the decline in the quality and number of Brahmini bulls. In short the system has outlived its day and is now quite unsuitable.

I think it is rather antiquated to-day to quote, at length from reports prior to 1914. Even the cattle-breeding dairy industry in India has made great strides since that date. I entirely concur that the importation of foreign blood is not a practical proposal for the improvement of the village cattle in India but this and all the remarks made on pages 4, 5 and the first paragraph of page 6 of your note are common knowledge to all who have studied the cattle question in this country. I do not agree that the Brahmini bull is an indispensable factor in improving the breed of Indian cattle. On the contrary the Brahmini system is a broken reed and is to a considerable degree responsible for the present unsatisfactory condition of affairs. The provision, distribution and control of the breeding bulls of the country should be entirely apart from any religious community, sect or organisation whatever and should in no way however remote be dependent on religious or other like sentiment. It is matter of business of serious moment to the whole country. I entirely agree that we need better breeding bulls, better methods of selection, rearing, feeding and management, and no scheme which does not include ways and means of growing and conserving fodder, of controlling the distribution and service of stud bulls, of castrating unsuitable males and of encouraging and developing not only the production of milk but its handling, transport and sale and the manufacture of milk products will really solve this question. Your note gives no details of how all these important matters are to be dealt with and consequently fails to solve this pressing and important economic problem. In short I consider your brief note on the whole states the existing position with care and makes out the need for improvement concerning which we are all agreed, but it is far too vague and incomplete to be classed as a "scheme" for the improvement of cattle-breeding in India.

As all the estimates given in the last page of your note depend upon the use of so called "Brahmini" bulls supplied free I cannot accept your figures.

This is an economic matter, a purely business question and it cannot be solved by an appeal to the religious susceptibilities of any one section of the community.

APPENDIX II.

Letter No. 688-R., dated Lahore, the 22nd June 1926, from C. F. Strickland, Esq., I.C.S., Registrar, Co-operative Societies, Punjab, to the Junior Secretary to Financial Commissioners, and Deputy Secretary to Government, Punjab, Development Department.

With reference to correspondence ending with your letter No. 2313-D, dated 1st June 1926, I have the honour to state that the attendance of two gazetted officers and six inspectors at the three months' course in Co-operative Dairying held at Bangalore last cold weather proved to be extremely profitable to the officers concerned, and the students from the Punjab were reported by the Imperial Dairy Expert to be the best who attended the class. Since their return they have been usefully employed in the formation of Milk Recording and Cattle-Breeding Societies in the course of their ordinary duties.

The sanction to sending these officers to the class was granted by your letter No. 656-D., dated the 5th August 1925, and provision has been made in my budget for the current financial year for sending an equal number of officers again to the course in Bangalore. I am now informed by the Imperial Dairy Expert that the Government of India are unable to sanction the admission of Punjab students to the course, but after personal inquiry I understand that this order is due to an apprehension that the Government of India, in undertaking a training class of this nature, may be thought to be trespassing in the sphere of Provincial Governments. The Imperial Dairy Expert is I understand extremely anxious to repeat the course this year, and I feel that it would be of the highest value to my staff. It is not possible to obtain in the Punjab a similar training, either at Lyallpur or elsewhere, and I feel that the anxiety of the Government of India would be removed if the Punjab Government were willing definitely to ask for permission to send Punjab students to Bangalore. The course began last year on September 15th, and there is therefore only a short time remaining within which the arrangement can be made. I beg that, if there be no objection, from the side of the Punjab Government, the Government of India may be moved to sanction the admission of my students.

The financial provision exists in my budget, and no additional expenditure will therefore be involved.

Letter No. 518-D(S)., dated the 13th July 1926, from the Financial Commissioner and Secretary to Government, Punjab, Development Department, to the Secretary to the Government of India, Department of Education, Health and Lands.

I am directed to say that by an arrangement made with the Imperial Dairy Expert, two gazetted officers and six inspectors of the Punjab Co-operative Department were admitted to the three months' course in Co-operative Dairying held at Bangalore last cold weather. The training thus received by these officers, has proved extremely profitable and the students from the Punjab were reported by the Imperial Dairy Expert to be the best who attended the class. Since their return they have been usefully employed in the formation of Milk Recording and Cattle-Breeding Societies in the course of their ordinary duties.

2. The Registrar, Co-operative Societies, Punjab, has now been informed by the Imperial Dairy Expert that the Government of India are unable to sanction the admission of the Punjab students to this course in future. It is not possible to obtain in the Punjab any similar training either at Lyallpur or elsewhere, and the Punjab Government (Ministry of Agriculture) is anxious to secure for its Co-operative Department Officers the very useful technical and specialised instruction imparted at Bangalore. It is understood that the Imperial Dairy Expert wishes to repeat the course this year, and is willing to take Punjab students if he is permitted to do so.

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3. The Punjab Government (Ministry of Agriculture) hopes that the Government of India will consent to assist it in obtaining for its officers the advantage offered by the course, and I am accordingly to request that the sanction of the Government of India may be accorded to the admission of the same number of students to the course to be held this year at Bangalore. All travelling and other expenses connected with sending the students to Bangalore will of course be met by this Government.

Letter No. 1458-Agri., dated Simla, the 31st July 1926, from J. W. Bhore, Esq., C.I.E., C.B.E., I.C.S., Secretary to the Government of India, Department of Education, Health and Lands, to the Financial Commissioner and Secretary to the Government of the Punjab, Development Department.

From a perusal of your letter No. 518-D. (S.), dated the 13th July 1926, it would appear that the Government of the Punjab are under the impression that a course in Co-operative Dairying will be held in Bangalore this year, but that students from the Punjab will not be allowed to attend. I am directed to say that this is not the case. The Government of India have decided not to hold such a course this year.

2. They have given their careful consideration to the question whether central institutions, which are intended primarily for research and for instruction of a post-graduate character, should also make provision for elementary short courses such as the one in question and they have come to the tentative conclusion that agricultural or veterinary education not of an advanced character falls more appropriately within the province of Local Governments than of the Government of India. It is possible however that the Royal Commission on Agriculture may make recommendations concerning the division of functions in regard to agricultural and veterinary training between the Central and Provincial Governments which may influence the Government of India to alter this provisional decision. Should this be the case and should the co-operative dairying course or similar classes be instituted by the Government of India, they would welcome the support of these educational activities by the Provincial Governments. For the reason indicated, however, the Government of India do not propose this year to hold the short course in co-operative dairying.

APPENDIX III.

Letter from Mr. W. Smith, Imperial Dairy Expert (on leave), Colinton, Midlothian (Scotland), dated the 16th June 1926, to the Agricultural Adviser to the Government of India, Pusa.

I have been advised by the Assistant Imperial Dairy Expert who is at present acting for me that the Government of India contemplate the closing of the Anand Creamery because they are not satisfied with the trading results of that institution up to date. In the first place, I desire to point out that it is impossible to gauge the commercial success or otherwise of such a factory in the short space of time that Anand has been worked by this department, because owing to delay in the issue of orders as to the taking over of this creamery by the Imperial Agricultural Department it was impossible to commence operations until the cheap milk season, when profits are made in the Gujarat butter trade was past. Secondly, I desire to call the attention of the Government of India to the great national importance of maintaining and extending this, the one creamery or dairy factory, educational and research station, in the whole of the Indian Empire. To take one aspect of the dairy factory problems which to-day deeply affect the economic position in India—the *ghi* problem—the position is serious. The value of the *ghi* produced in India yearly cannot be below Rs. 1,00,00,00,000 per year and it is no exaggeration to say that the existing systems of *ghi* manufacture are crude, wasteful and filthy. These methods are not only wasteful in the outturn of *ghi* which they give from a given quantity of milk containing a certain percentage of butter fat, but they are doubly wasteful in that they make no provision for the proper utilisation of the by-product of *ghi* manufacture, namely separated or butter milk. In many of the districts where *ghi* is made in enormous quantities by jungli tribes who own large herds of buffaloes, the butter milk is simply thrown away in the flush season. This butter milk contains more than half the nutritious constituents of the milk in a highly digestible form, and the present value of dried separated milk in India at the ports is some Rs. 700 per ton. It is certain that under present conditions India deliberately wastes a sum of not less than Rs. 5,00,00,000 per year in failing to make proper use of the by-products in the manufacture of *ghi* and if to this sum there is added another Rs. 3,00,00,000 per annum as representing the actual loss in *ghi* outturn due to crude methods of manufacture, we have the truly colossal loss to the wealth of India of Rs. 8,00,00,000 per annum due wholly to want of technical knowledge and organising ability on the part of those engaged in the *ghi* industry.

It was primarily for the purpose of tackling this pressing problem and of attempting to in some degree prevent this enormous drain on the wealth of India that I pressed Government for so many years to take over the Anand factory and it was mainly with this end in view that I inaugurated classes for the instruction of officers of the co-operative departments of Provincial Governments and Indian States. This *ghi* question and in fact the whole question of manufactured dairy products cannot be investigated or dealt with outside of a properly equipped dairy factory situated in one of the milk-producing areas. No better situation and no more suitable factory site is obtainable than Anand, and to close down this creamery before it has even commenced its work of education and research will be a truly national calamity. The dairy section of the Imperial Agricultural Department cannot do its duty by the country without a thoroughly equipped modern dairy factory and it seems inconceivable that the Government of India will close Anand Creamery and build and equip another creamery at some other place. This question of manufactured dairy products such as *ghi*, condensed milk, evaporated milk and curd products is a truly national one. Every Province, and State, in India manufactures and consumes *ghi* to a greater or lesser extent and *ghi* is manufactured, adulterated, and re-transported from Province to Province all over the country. Not only is this question national from this point of view but it is even more truly national from the public health aspect. It is safe to say

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that there is no food product so universally consumed by all castes and classes as milk, *ghi*, and the milk products; and it is certain that there is no food product eaten in India which is manufactured, handled and adulterated with such filth and utter disregard to cleanliness as *ghi*. *Ghi* is offered for sale in every bazar in India adulterated with every known form of fat from petroleum jelly to the fat obtained by steaming the bones of dead animals. Surely the prevention of this abominable state of affairs is a national question, and this can only be done by the dissemination of knowledge of improved methods, and by the education of the dairy trade. Very little is at present known as to the best methods of manufacture of *ghi* and the milk products from buffaloes milk, research and experiment in this direction is most urgently needed, in fact the whole country is crying aloud for it. This kind of work can only be done at a State dairy factory such as Anand.

The importance of the *ghi* industry alone (only one branch of the dairy factory industry) is certainly of equal magnitude to that of the steel industry in India, and yet the Government of India are paying yearly in bounties to one steel manufacturing company more than the total cost of the Imperial Agricultural Department. I suggest in view of the foregoing that instead of closing down Anand Creamery, the Government of India make provision to extend its activities, and do something for this hitherto neglected but nationally important industry.

Oral Evidence.

A.1. *The Chairman*: Mr. Smith, you are the Imperial Dairy Expert?—Yes.

A.2. You have put in a very interesting note, for which the Commission is indebted to you. Would you like to make any general statement at this stage, or shall I ask you a few questions?—I think you had better ask me a few questions.

A.3. I have your note of evidence before me, and your statement seems to me very clear and complete. But there are one or two details as to which I should like to ask you. On page 6 you say, "I regard the animal nutrition work of the Physiological Chemist as of vital importance to the agriculture of India, and it has been the aim of this office to co-operate with him in every possible direction." I take it that the work of the Physiological Chemist is only at its beginning for the moment?—Yes, it has been going on since 1920, about six years.

A.4. There is a great deal of work still ahead?—Yes.

A.5. And it is your view that the quantity of this work is likely to grow and that a separate herd at a separate farm is really likely to be required in the near future?—I entirely agree.

A.6. On page 7, you make out a case for a dual purpose animal. What indications are there that it is going to be possible to evolve a dual purpose animal, likely to thrive over the greater part of India?—The best breeds we have in the country to-day, such as the Haryana, are dual purpose animals. The Ongole breed in this part of the country and the Scindi in parts of Sind, as well as other less clearly defined breeds, have the dual purpose qualities now. In fact, the best breed of bullocks we have, with perhaps one exception, that of the Amrit Mahal, comes from animals which are largely dual purpose.

A.7. You see no reason why those breeds should not be in a position to provide dual purpose cattle for all the climatic and geographical conditions in India?—Certainly none. The quality of giving milk is the mark of maternity and I know of no reason why a first class mother should not be the dam to a good class of bullock of any type you like.

A.8. I wonder whether you could let the Commission have, at your convenience, a list of the breeds of which you have experience, with any facts about them that you think might be interesting?—I could do that with pleasure. (See Appendix I on page 46).

A.9. On page 8 of your note of evidence, you state the changing conditions which have brought about the contraction of the jungle-feeding grounds available for cattle. In connection with that, have you anything to say, from your experience, about forest management in relation to the fodder problem?—No, I have had very little experience; what experience I have had in dealing with the Forest Department with regard to this problem was in the Military dairy farms, and we found them very ready and willing to co-operate in every possible way.

A.10. Have you anything to say about the preservation of fodder in forests as an insurance against fodder famine?—I think the conservation of fodder or the preservation of fodder is one of the most acute problems in the country to-day, and the storing and conservation of fodder in forest areas would be useful along with that produced from all other types of land in the country.

A.11. On page 9, you point to the castration of unfit males as being an essential step towards the improvement of cattle breeds in India. What degree of prejudice against castration have you met with?—It depends on the locality and the caste of the people. Amongst the Jains in parts of Gujarat, of which I have had a good deal of experience, they simply will not do it at all. I have seen villages in Northern Gujarat, after two or three good years, with as many as 120 buffalo bulls, which were quite useless as breeders, wandering about the outskirts of the village, none of

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them castrated. In the Punjab, where you have a large Mahomedan population, and other parts of India, there is very little prejudice. In the stricter Hindu areas there is some prejudice, but I believe it is gradually breaking down. I do not think it is a serious matter to-day, because you can have bloodless castration, which most of the castes will agree to.

A.12. Is it done by crushing?—It is done by the Italian method of simply severing the cords by means of forceps and pressure.

A.13. While on the subject of prejudice, is there any sentimental objection to weaning?—There is a good deal of that in the country. It is entirely prejudice. I do not think it is supported, as far as I can find out, by any real religious teaching on the subject, but there is a prejudice against it. I think it can be overcome. The prejudice exists more among the lower orders who have to deal with cattle, that is, the men who actually attend on them. When I was in the Military dairy farms, we introduced a regulation to that effect and enforced it rigorously, and after the first year or two there was no trouble whatever.

A.14. Does it exist with regard to buffaloes with equal intensity?—No.

A.15. I do not know whether you could enlarge at all on what you have said, on page 9, about the successful experiments in parts of the Punjab in the matter of providing good pedigree bulls?—Probably, detailed information of that sort had better come from the Punjab Government. I have control of a farm in the Punjab, and I am fairly well acquainted with that part of the country. I have spent a good deal of my life there, and certainly the effect of the bulls issued by the Punjab Government is shown in that part of the country where they have been doing it for so many years. It is clearly shown, and to my mind it has effected a distinct improvement. I think the Punjab Government would have done well to have paid more attention to milk in the selection in the earlier stages; but they have taken up that question now, and the breed which they have gone in for primarily for this purpose, the Haryana or the Hissar, as they call it, certainly possesses considerable milking qualities. We are testing some of them now on behalf of the Punjab Government at the farm. We purchased 24 of their cows and we are getting most excellent results. Some of them give quite good yields of milk.

A.16. Is it the case that whereas it is difficult to produce a dual purpose animal designed to produce milk and meat, a dual purpose animal to produce milk and working males is not difficult to come by?—That is my opinion. The best draught bullock in Sweden, for instance, is the Holstein. The whole of South Sweden is cultivated with the Holstein bullock.

A.17. The Commission notes what you say on page 9 with regard to the class for instruction of officers in the Co-operative Departments of all the Provincial Governments and Indian States, and also what you say on page 10 in the matter of the Creamery at Anand in Gujarat. You are very anxious to keep that Creamery in your hands?—I am.

A.18. On page 10, you say "Within the last 20 years India has lost the valuable butter export trade to the Far East because of the inferior quality of her butter, due to lack of technical knowledge of methods of manufacture." Can you give us the facts about that?—I have not got the export figures, but up to practically 1913, there was a large export trade done between this country and Ceylon, Penang, Singapore, right round as far as Hongkong, Saigon, Bangkok, and all those parts. That trade, I am told by the butter merchants interested in it, has been completely lost. I was in Rangoon sometime ago, and when I saw some of the butter merchants there about it they told me that they were so sick of the quality of butter received from India, that they had given it up entirely in favour of Australian butter. In Rangoon they said that although the Indian butter was better for them because of its higher melting point, the quality was so variable and so bad that they could not sell it alongside the Australian tinned butter.

A.19. *Mr. Calvert*: Have you any idea of the volume of that trade?—I have not got the figures as to the volume.

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A.20. *The Chairman*: The figures of export for the last 12 years or so do not appear to support the view that there has been a decline?—They would not, because the War came in, and all the butter that could be got from India was sent to the seat of War. The organisation that I was in charge of was sending 11½ tons of butter a day for more than two years. We practically bought the whole of the milk in Gujarat in those days. It was before that that they had this export trade.

A.21. So that the figures between 1918 and 1925 do not show the decline?—No, they would not.

A.22. Before we go on any further with your note of evidence, I should like to ask you whether you support the opinion put forward to the Commission by Mr. Bruen, that the fact that the she-buffalo is the principal milk-producing animal of such a large part of India, is one of the principal obstacles to the improvement of the cow as a milk-producing animal. Perhaps you heard Mr. Bruen's evidence?—I heard his evidence.

A.23. What have you to say about that?—I do not think it is putting it in the proper way to say that the buffalo is a menace to the improvement of the cow. The buffalo is there because of the poor quality of the cow, and I think that the improvement of the cow will gradually eliminate the buffalo. I have been told that that has been the case in Italy, particularly, and in some of the Balkan States. I met the Chief of the Dairy Division of the Italian Government this year, and he told me that because the buffalo was a poorer animal for beef it had been gradually eliminated, as they produced better milkers amongst cows, and I think the same thing will take place here. The cow generally in India gives no milk and therefore the people have to keep the buffalo.

A.24. *Mr. Calvert*: What is the draught animal in those countries, the horse or the ox?—In Italy largely the ox.

A.25. *The Chairman*: The point being, I take it, that you have got to have the bullock to do the work, you have got to have the cow in order to produce the bullock, and if the cow can also produce the milk, then you can do without the buffalo?—Yes. I say the cow can produce milk and ought to; you cannot work the cow.

A.26. So that the order of effort should be to improve the cow first, and you think then she will displace the buffalo?—Yes.

A.27. How about the question of early sexual maturity? Has any work been done on that question?—Early general maturity means early sexual maturity. The age of sexual maturity depends on the degree of development of the animal. If you have better breeding and better feeding, you will get earlier general maturity, and with it sexual maturity.

A.28. Is it the case that cows in India do not, as a general rule, throw their first calf until their sixth year?—It is very difficult to state a figure; it is certainly coming near to that if you take the general average. The cattle on the Government farms throw their first calf nearer the third year, showing that what I say is correct.

A.29. *Sir Henry Lawrence*: You accept it in the villages as nearer six years?—I should say so.

A.30. *The Chairman*: It is a question of nutrition?—It is a question of nutrition and breeding. There is no selection in the villages. The capacity of an animal to make good use of nutrition depends upon the way it is bred.

A.31. One does not usually associate high breeding with fecundity?—Well, we have never come anywhere near to the high breeding in Europe.

A.32. Then I should like at this stage to ask you for your opinion about the Military half-breed dairy farms?—I was employed in the Military dairy farms for 15 years; it was at my suggestion that the Military authorities adopted this system, and naturally I support it.

A.33. The half-breed system?—Yes. I believe myself that the Military dairy farms in introducing foreign blood did exactly the right thing from their point of view. There is no way or method that I know by which

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they could have got milk at the price at which they obtain it now from the half-breds. The Military dairy farms organisation was formed and exists for a specific purpose, that is, primarily, to supply the British troops and Indian station hospitals with pure and safe produce, and to get that at the lowest possible figure there is no doubt that they have to employ foreign blood.

A.34. Is it your view that they should continue to employ foreign blood?—It is, as long as their purpose remains as it is now. That is the *raison d'être* of the Military farms.

A.35. It is a question of cost?—It is for entirely economic reasons, as everything connected with cattle-breeding should be.

A.36. Have you measured the advisability of sacrificing economic efficiency in the Military dairy farms and using the agency of the farms for the improvement of indigenous breeds?—I asked at one period of my career in this department that the whole of the Military farms should be handed over to the Civil Department. The then Agricultural Adviser strongly supported the idea, but they were not given to us. At the same time, if we were to use the Military farms for that purpose we should have to alter the system of breeding altogether. I do not believe in the introduction of foreign blood into India for the general improvement of village cattle under existing conditions.

A.37. Second and third crosses are disappointing, are they not?—You will see some of them this afternoon. In a climate like this the second cross, that is, the three-quarters Ayrshire, is fairly good. The seven-eighths are more weedy. The three-quarter is not nearly so good as the half-bred; the seven-eighth is worse. The F. 2 is useless. We bred about 140 of them before the Civil Department took it over, and I think we got about five good cows out of the lot.

A.38. So that although the Military dairy farms are carrying out their primary function very efficiently, they are making no contribution towards the improvement of the indigenous breeds in India?—No; it is not their function.

A.39. Is it your view that these farms should be handed over by the Military to the Civil Department?—I think, if the Government of India could find the extra cost, it would be a good thing for the country.

A.40. How about the milk for the troops?—If they were taken over for that purpose, whatever department took them over would have to guarantee the milk for the troops. It would cost considerably more money in the earlier stages.

A.41. *Sir Henry Lawrence*: Why more money?—Because you would have to revert to a system of using Indian cattle. The present system of the Military dairy farms from a breeding point of view leads nowhere. You would have to build up indigenous herds at each centre. It would cost a great deal of money to do that, but it would be worth it.

A.42. *The Chairman*: You say it would cost a great deal of money; have you any idea how much?—Without going into the details I cannot answer. There are 34 of these farms, and they differ in every possible way.

A.43. I observe on page 11 you think that there is ample scope for the Veterinary Services in the prevention and cure of animal diseases?—Yes, the prevention and cure of animal diseases I consider to be their function.

A.44. Do you attach importance to breeding and heredity in relation to resistance to disease?—Yes, it is a factor undoubtedly.

A.45. Have you anything other than that which you have set down in your note that you wish to say about the Veterinary Services or about Muktesar?—No; generally speaking I have found the Veterinary Services very ready to co-operate so far as they possibly can. My experience, of course, has been more with the Army Veterinary Department, as I was much longer in the Military Department than I have been in this department, and we found them exceedingly useful in their own sphere.

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A.46. What about Muktesar?—Muktesar has given me a great deal of assistance here. They also carried out the simultaneous inoculation for eight years of my service in the Military dairy farms with extraordinary success. We simultaneously inoculated between 1912 and 1916 practically the whole of the animals under my charge in the Southern District of the Military dairy farms. This was done by Muktesar, with practically no loss. Since then there has been practically no rinderpest and no losses from rinderpest in that area.

A.47. *Mr. Calvert*: What is wrong with Hissar?—I do not think there is anything wrong with it.

A.48. Why do you say you would rather take it away from the Veterinary Department? It has been under veterinary control for many years?—I consider the officer in charge of Hissar is probably one of the best farmers and one of the best stock breeders we have in this country. Apart from being a veterinary officer he is a trained and experienced farmer, and a skilled breeder. His work at Hissar is beyond praise; there is nothing wrong with it.

A.49. Do you think it is impossible to have other veterinary officers of the same type?—I think it would be a great pity, in view of the extraordinary need for skilled veterinary men, to turn these men away from the prevention and cure of animal disease. The country cannot afford it.

A.50. *The Chairman*: Do you think yourself that the time has come for an All-India Act dealing with epidemic animal diseases?—Do you mean the restricting of the movement of animals?

A.51. I do?—No.

A.52. Why?—I do not think it could be given effect to. You would have to increase the Veterinary Service to a much greater extent, and that would take time. It would have to be extended and very much more spread over the country, to do anything like that with efficiency. I speak as a layman in regard to that.

A.53. Do you wish to add anything to what you say on page 11 as to the advisability of the formation of a Central Cattle Bureau according to the recommendation of the Board of Agriculture?—Yes, I believe that that Central Bureau would do very good work; but I do not think that such a bureau can take the place of a general central organisation for the guidance and co-ordination of agricultural effort in the country. The Cattle Bureau will perform a specific work if it gets the necessary staff; it has not been provided with it yet.

A.54. I grasp your plan for the organisation of research work and subsequent breeding experiments. Have you worked out in detail how you propose to get down to the cultivator?—Do you refer to dairying research or cattle-breeding?

A.55. In regard to dairying first?—We have first of all to discover how and under what conditions we have to carry out these various operations. As soon as we are able to say definitely how that is to be done and we get the results of our research work, I should be greatly in favour of getting to the cultivator through the agency of the Co-operative Department. I believe that this particular industry, the manufacture of milk products, is specially suited for being carried out on co-operative principles. That was the very reason why I started this class for co-operative officers to get into touch with these men to find out what their ideas were and how much we could assist them. In my opinion in this country if industries of this sort are started by private enterprise the real producer of the milk will not get a proper share of the profit. In practically every country in the world where they have made a success of dairying they have taken up co-operation for the factory part of the work. It has been particularly suitable.

A.56. Have you personal experience of producers' co-operative organisations in this country?—No, I have very little experience in this country. I have experience of it in some other countries.

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A.57. But not in this country?—No.

A.58. Have you formed any view as to the soundness of the co-operative societies in this country?—I have come into touch with very few of them. The only ones I know intimately are the Calcutta Co-operative Societies Milk Union; I regard it as a sound and very well-managed concern. They are doing wonderful work in Bengal at the present time. I have advised them ever since I came into this position.

A.59. Where you can establish co-operative dairying, of course you would at the same time establish your machinery for the improvement of breeds?—I should hope so.

A.60. Now think for a moment of villages where dairying would not be taken up. How do you propose in areas of that nature to get down to the villagers and to show them how to improve their working cattle?—The first thing is to supply them with a bull or bulls, and to see that the other males in the village are castrated. That is the first thing that has got to be done, but before we can do that we have got to build up a pedigree. If you will pardon my saying so, I do not think we can worry about crossing the bridge before we reach the stream. The first thing we have got to do in this country is to get pedigree. I have got animals for Government which were supposed to be pure; we sent them long distances at great cost; they were beautiful animals to look at. We made every enquiry we could about their ancestry, but when they started work they produced a collection of weeds. That is happening all over the country. It is no use distributing bulls until they have some power of handing on the qualities they are supposed to possess.

A.61. I quite agree if I were in your shoes I should not worry about crossing the bridge yet; but from our point of view this question of getting down to the cultivator is of such interest and general application that we like to ask witnesses if they have thought the matter out?—There are two or three agencies which you could employ. Co-operative societies would be a very good thing. The bulls distributed in the Punjab are looked after as far as their maintenance and health are concerned, by the Veterinary Department who have a staff large enough to deal with it; that is necessary too.

A.62. You think that is a good scheme?—In the Punjab it works very well. Any agency that will look after the bull, see that the use of other bulls is prohibited, and more or less keep a record of the servings accurately, is good enough. You may use the panchayat or the co-operative society, or you may use the Government of India Department.

A.63. You do not think that by employing the Veterinary Service in that direction you would distract their attention from disease problems?—I think the Veterinary Department could do it quite well, but at the same time it must be borne in mind that if you give them a great deal of that to do, they cannot do the other. The efficiency in that case would depend upon the quality and quantity of the staff they have. I do not think it is of any importance what agency does it; the point is that it has got to be done.

A.64. I think the difficulty is the vast area and the enormous number of villages?—That, of course, is a question of ways and means. I do not think there is any difficulty underlying the principles applicable. The greatest difficulty now is to get the cattle.

A.65. Have you formed any idea as to how long it would take you, given the means that you require, to evolve on pedigree lines?—I should think you would effect a distinct improvement on the third generation and even the second would be better than what we have now. The first is selection, the second is breeding by selection, and the third goes on accumulating the benefit. The effect of all this is cumulative from every point of view.

A.66. Are you satisfied with the facilities for teaching dairying at the Institute?—No, I am not satisfied.

A.67. Do you wish to add anything to your note in that respect?—I think it should be considerably extended, the staff should be increased and the

students' hostel accommodation especially should be increased. We had a great many more applicants for this Diploma class that we teach than we were able to take in both cases. I think from the dairying point of view, unless we can turn out men of the practical type that we are attempting here to turn out, there is a very little hope for the dairying industry. The people who now run it have very little knowledge of the technique of the subject.

A.68. Do you keep in touch with your Degree and Diploma men?—I have only passed out one class of Diploma men; I am in touch with all of them. It is not a difficult matter at present.

A.69. Do they come from a wide area of the country?—They come from all over India. The present class is the same. We made our selections purposely in that way. The first time we took one-fourth of the number of applicants, and this year we took about a third. We took them from all over India, not only from a geographical point of view, but from different castes as well.

A.70. Accurate records of their careers will be very interesting in a few years' time, will they not?—Yes. We are not keeping official records, but we could easily do so.

A.71. Following the order of your note, I gather that you have little hope of making scientific modern dairying an economic proposition until reasonable standards of purity and hygiene are insisted upon in the large consuming centres?—That is so.

A.72. Are you thinking of local Acts to enforce standards of that nature, or have you in mind an All-India Public Health Act?—I do not think it matters whether it is All-India or Provincial. As a matter of fact in the larger centres to-day they have got statutes having the force of law which would adequately protect the dairy industry if they were enforced. In Bombay, Calcutta and Patna, I myself was called upon to advise with regard to the drawing up of these Acts, and the standard there adopted, which has now the force of law, would be all right if it were enforced; but I venture to say that in these three towns the milk sold is so bad that it can hardly be described. Mr. Bruen told you, I think, that you can go to a milk vendor in Bombay and he will say, "you can have pure milk or any grade you like below that", and he adds the water. I quite agree with Mr. Bruen. It is contrary to law in Bombay to adulterate milk, but public opinion has not got to the point at which this law is enforced. It is I believe improving.

A.73. I gather from your note that you find provincial officers very ready as a rule to co-operate with you?—Yes, we keep in touch with all the provincial cattle-breeding officers, and where there is no specialist cattle-breeding officer we have been in touch with the Director of Agriculture.

A.74. Do you think provincial cattle-breeding officers are in touch with the work of cattle-breeding officers in other Provinces as well as with your work?—I am afraid they are not. There is no means. That is one reason why the Board of Agriculture pressed the establishment of the Central Cattle Bureau so that there would be a central way of their coming together and each finding out what the other was doing. Most of the cattle-breeding officers and directors of farms write to this office and keep in touch with this office for technical information regarding dairying matters more than cattle-breeding.

A.75. It is no part of your function to correlate the work as between Province and Province?—No, not to my knowledge. It will be part of the function of the Central Cattle Bureau when it is organised.

A.76. What dairying and cattle improvement journals have you in India?—None.

A.77. Is there room for a journal of that sort?—I think there is. I believe Dr. Clouston has proposed the establishment of such a journal.

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A.78. In the meantime you have occasional articles in other journals?—We have occasional articles in the *Indian Agricultural Journal*, when we have time to write them.

A.79. *Sir James MacKenna*: I see that in your memorandum you lay great emphasis on the retention of the Anand Creamery?—Yes.

A.80. Do you not think it would be better to take the opportunity of starting a new model factory instead of retaining Anand?—No. The Military dairies took two years to get a suitable site in days when the Government of India had control of the land there. Now the land and all that sort of thing is controlled by the Provincial Government. I think it would be impossible for us to get any site anything like as suitable as Anand for the establishment of an experimental and educational dairy factory. Anand is situated at the junction of four railway lines, right against the station; it has got a first class water-supply, and that is very valuable. It is very difficult to get a good water-supply for a creamery; a creamery requires a great deal of water.

A.81. The future of this creamery is somewhat in the balance?—Yes.

A.82. Do you think that the maintenance of this creamery is a matter of such importance that the Royal Commission should make an *interim* recommendation apart from their final recommendations?—I would greatly appreciate it. I have suggested that the Commission should send some one to see the district and see its extraordinary possibilities from a dairying point of view. It is the one real dairying district in India.

A.83. I see from page 10 its position is precarious?—I have been told so.

A.84. You recommend that the Royal Commission should, if possible, depute a section if not the whole Commission to visit it?—It would be a very good thing. I think they would agree with me when they see the place and conditions.

A.85. What special lines of research and experiment have you been able to take up since you received this appointment, on the various farms you have?—We have taken up very little of experimental work. All that we have taken up with regard to cattle-breeding is the demonstration of dual purpose animals, like the *Hariana*. We have also carried on cross-breeding work here with a view to demonstrating milk production. In regard to investigation into dairying problems, we have done some original work here in connection with the neutralisation of sour cream by lime, and the sterilisation of milk, one or two minor points of that type; things that could be taken up here were done by the dairy staff with the assistance of Mr. Warth. Mr. Warth, who happens to have his laboratory there, has co-operated loyally with us. We have been able to do one or two little things like that, but generally speaking we have not yet tackled any of the major problems.

A.86. What happened during the gap of three years between your appointment as Imperial Dairy Expert and the taking over of your farms?—Nothing happened. We had no funds and no facilities to do anything. I used to write to Mr. Milligan almost every day for three years and then we got these three Military dairy farms.

A.87. How did you keep yourself employed?—By giving advice and drawing up plans for people, things like that; we did what we could; I think the time was wasted.

A.88. So that you really lost three years?—Yes.

A.89. What do you think is the main cause of the inferiority of cattle in this country? Is it due to lack of means, or lack of care, on the part of owners?—I think it is lack of knowledge. The breeding classes are probably the most ignorant and prejudiced people in the whole country. They had vast areas to roam over in the old days, and they are now restricted, with the result that they have turned into professional fodder thieves. I think you will agree with me that in Northern Gujarat they certainly are professional fodder thieves. We want to get cattle-breeding into the hands

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of a better class of people. That is why I stress the point that the cultivator must be the breeder.

A.90. *Dr. Hyder*: Where were these vast areas of which you are speaking?—There were vast areas in the Punjab; there are now vast areas in Bihar and Orissa, and North Arcot (Madras).

A.91. Where are these areas in the Punjab?—The present canal areas were all given over to cattle-breeding. The Sutlej Canal has been brought into a district which was occupied by cattle-breeders. In Montgomery there was nothing but cattle-breeding; Lyallpur district was the same.

A.92. My point is that at present these areas do not exist in the Punjab; the land is under the plough?—Certainly it is, but they were grazing areas before the canals were excavated. The canals have converted these areas into agricultural lands now. It is the canal which has driven the cattle-breeder into the corner.

A.93. But these jungle cattle-breeders have taken to cultivation?—They are gradually. Attempts are being made to get them to take up land and in some instances they have done so. Generally speaking, I believe the men who were brought in as cultivators were not the jungle cattle-breeders.

A.94. In Bihar you say there are vast areas?—There are vast areas in the hill tracts of Bihar now that are given over to cattle-breeding. Then in North Arcot there are thousands of acres of it, covered with cattle, the worst weeds you have ever seen. There is no system whatever in the breeding.

A.95. *Sir James MacKenna*: With reference to your answer to the Chairman as to All-India legislation on cattle diseases, apart from the necessity for increasing the veterinary staff to enforce such legislation, do you consider a considerable strengthening of the Veterinary Department is desirable in the interests of agriculture?—It is certainly.

A.96. Do you think that if by the strengthening of your Veterinary Departments you can save the lives of 4,000 animals, that would be equivalent to an enormous increase?—Yes, that is so; I believe it would be entirely economic to increase the veterinary staff enormously.

A.97. Are there any points on which you consider an early expression of opinion of the Commission, in connection with this new branch of agricultural research is necessary in order to prevent the stopping of important work?—I think it is of vital importance to the Central Department of Agriculture that something should be done to modify the existing Devolution Rules. I believe that the lack of funds from which we are suffering and the restriction of our work is largely due to the fact that under the Devolution Rules there is no real place for a Central Department of Agriculture. It is distinctly stated in those rules that Agriculture, including research, is a Transferred subject, and consequently the Government of India rightly feel that they cannot co-operate with the Provinces if it costs any money.

A.98. Such co-operation is of course absolutely essential for the development of your work?—Yes, undoubtedly. This co-operative class of mine that I was so keen on has been stopped solely on account of that. They say, "Really it is exceeding our powers under the Devolution Rules."

A.99. In these one or two matters, would an *interim* report or expression of opinion of this Commission be of the very greatest help?—It would.

A.100. Both to you and probably to the Government of India?—I think it would.

A.101. And to Local Governments too, probably?—Yes.

A.102. There is no lack of will on the part of Local Governments. In point of fact the correspondence shows there is a desire on the part of Local Governments to have the advantage of this centralised instruction or assistance and the letter attached to your memorandum has probably been written with the authority of the responsible Minister?—I think so.

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A.103. So that it looks as if it were a point on which, if this Commission could give an expression of opinion, there would be unanimity of acceptance?—Yes.

A.104. *Professor Gangulee*: In reply to Sir James MacKenna you stated that you were appointed in 1920 and that for three years you had practically nothing to do?—I did not say that. I said that I did not have the legitimate work that I should have had to do. I occupied my time as well as I could.

A.105. And during that period your expenditure was something like Rs. 98,000?—It was Rs. 26,000 in 1921; Rs. 33,000 in 1922; and Rs. 39,000 in 1923. That is, about Rs. 98,000.

A.106. Now with regard to your educational system, I see that you have got something like a graduated system of dairy education. In the first place, you have got the post-graduate arrangement; then the Diploma arrangement and the short course arrangement. The Diploma course is for two years?—Yes.

A.107. Could you kindly give us an idea of the syllabus?—I have given every member a copy of the syllabus.

A.108. In the short course you have 74 students?—We had, during the last two years.

A.109. How are the students utilising their knowledge?—Nearly all of these men were officers in the various departments of agriculture, with the exception of a few students engaged in the dairy business. They were nearly all men sent to us by the various agricultural departments throughout India, and they returned to their posts after they had finished.

A.110. So that there is that degree of co-operation between yourselves and the Provinces?—Yes.

A.111. On page 6 you have answered the point about research work. You state here that little or nothing has been done to solve the many pressing problems affecting the dairying and cattle-breeding industry. Are you referring to any fundamental research?—I have specified some of the lines of research that, I think, are most generally needed. I would class these as fundamental.

A.112. And you have not been able to undertake any of these researches?—No.

A.113. You lay a great deal of emphasis on the dairy industry. Are you of opinion that the dairy industry in India has a great future before it?—I am.

A.114. You say, in reply to a letter from the Honorary Secretary of the All-India Cow Conference, that even the cattle-breeding and dairy industry in India have made great strides since 1914. Can you tell us in what particular direction these great strides have been made?—Principally in the establishment of this place here and in the appointment of Cattle-Breeding Experts by almost all the Governments in India. There was nothing done before that. These two things I consider were the first real movement, and they are of great importance.

A.115. Do you agree with me that the dairy industry depends to a great extent on the climate, the soil, the water and fodder-supply of certain regions?—All these are factors.

A.116. Have you undertaken a survey showing what may be called the potential dairy areas in India?—No.

A.117. Do you not think it would be useful?—It would be, but it is not nearly so important as the improvement of the cattle and the investigation of the dairy problems. It is of no use my being able to say that this particular place is fitted for the dairy industry until I can tell the people how to conduct it.

A.118. Would it not be useful if you could define a dairy belt in India?—There is no dairy belt.

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A.119. The dairy areas?—I do not think you can classify it. The whole country must be dairying because the whole country must be cattle-breeding. You cannot work India without cattle; you cannot get a bullock without a cow and therefore the cattle problem arises all the time.

A.120. Do you not think that geographical limitations are a great handicap?—They are a factor, but they are not the primary factor.

A.121. With regard to the dairy industry, you recognise that a scheme for milk-recording is fundamentally necessary?—Yes, it is.

A.122. Have you adopted any such scheme?—Yes, we have. Records on these farms have been kept carefully of every drop of milk produced since they were started. On this farm, and in fact all the Government farms, there is a record kept of every drop of milk since it was started. That applies to Pusa.

A.123. Is there any recording of milk among the cultivators?—Generally speaking, none.

A.124. *Dr. Hyder*: Have you got any figures of the average cost of such a scheme of milk recording and testing?—No, I could not give you the cost of anything like that; our figures are too much intertwined. There is one man who does this work, and of course he does a great many other things as well.

A.125. Are you aware of the cost of such schemes in other parts of the world?—Well, generally speaking.

A.126. Is the cost high or low?—Low. A great part of the work is done by the staff that would in any case be there. The authenticating of the records is the thing that costs money. That is generally done by central bodies with Government assistance; in fact, it is done all over the world in this way. That, I think, should be one of the primary functions of this Cattle Bureau.

A.127. *Professor Gangulee*: On page 8, you refer to these dairy products as being a village industry. You do not conceive of a time when the dairy industry could be run on a factory scale?—I do.

A.128. Do you think it could be a village industry run on factory lines?—Well, we could have a factory where we have collected milk. You can make cheese in Scotland, where you have got large enough holdings to provide a sufficient supply, but you cannot make cheese in Ireland on the farm; you have to have the factory system, and the same applies to Holland and Denmark which have a village factory industry. In fact, I go further and say that it cannot be economically worked upon any other basis. All that would be necessary would be your plant and buildings.

A.129. On page 8 you say, "The building up of pedigree herds in India must be a losing business for many years to come and therefore it can only be done by the State." What breeds in your opinion should form the foundations upon which dairy herds could be built?—The Scindi, the Thar Parkar, the Haryana, the Ongole of Southern India, the Amrit Mahal (I should get milk into the Amrit Mahal), the Dangi as it is called. These are probably the most pure and the breeds from which we are most likely to get good results at an early date.

A.130. Have you got any definite data to show that these breeds that you have just mentioned should be the foundations upon which dairy herds could be built?—I have definite data of them all except the Amrit Mahal.

A.131. What was the basis of your selection of stock?—The basis of selection was the milking test *plus* form. Every animal I bought I milked for two days; in fact I have never bought a cow in this country without having her milked in my presence, and I weighed the milk myself.

A.132. *Mr. Calvert*: Do you omit the Sahiwal breed?—Yes, I omitted it advisedly. It is not a dual purpose animal; it is not good for draught in my opinion.

A.133. Would you include the Dhunni?—It will make a very good foundation. It has no milk, but in that respect it is like the Amrit Mahal. It is a very distinct breed, and it is a very good one.

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A.134. *Professor Gangulee*: So milking quality is the basis of your selection?—No, milking quality *plus* draught quality, or one can put it the other way round. I say they have got to go hand in hand.

A.135. There are two qualities certainly, milking and draught?—Yes.

A.136. In milking quality, do you go by the percentage of butter fat?—Yes.

A.137. With regard to the distribution and control of pedigree bulls, do you think the registration and inspection of breeding stock would be required for the improvement of the livestock of the country?—Registration and inspection of pedigree herds will certainly be required.

A.138. The Government of North Ireland have introduced a system of compulsory registration?—They have.

A.139. Do you think the time has come for this country to adopt that measure?—No, not nearly come.

A.140. With regard to castration of unfit males on an organised scale, would you make it compulsory?—That again is a veterinary question. It would be a very good thing if you could do it, but it is no use making anything like that compulsory until you have a fair chance of enforcing it. I do not think with the present staff and arrangements it could be enforced.

A.141. If you had the staff and the machinery, you would be in favour of it?—Yes.

A.142. You think it is fundamentally necessary?—I think it would be a very good thing.

A.143. With regard to the service bull, have you any scheme by which this service could be made popular?—Give it for nothing, and have no other bulls.

A.144. You would not utilise the Local Boards and District Boards for the purpose, to give it free?—Yes, that is what I mean; give it free, charge nothing, and have no other bulls. There is no doubt as to the popularity of that.

A.145. You will make it popular if you give it free?—Yes.

A.146. *Dr. Hyder*: They are unpopular if you give them free, are they not?—No; where they get them for nothing the bulls which have been distributed by most Governments are very popular. In fact, the tendency in most cases is to give them far too much work.

A.147. *Professor Gangulee*: From your experience of the co-operative organisations in Europe, do you think co-operative organisations could be utilised as a suitable agency for the improvement of livestock in the country?—I do.

A.148. The conditions affecting the dairy and cattle-breeding industry in this country are widely different from those of Europe, are they not?—They are.

A.149. Do you think we could possibly utilise the co-operative organisations in the same way in this country?—I should certainly think so. I see no reason why we should not; human nature is the same throughout; that is the basis of it all.

A.150. *Mr. Calvert*: I am not yet clear in my own mind on this question of the deterioration of cattle. You say that the quality of the cattle of India gets worse from year to year? Do you put that forward as a scientific statement or just a popular opinion?—It must be a matter of opinion.

A.151. I was thinking of the Sind Sagar Doab, where conditions are exactly the same as they were hundreds of years ago, and where the people still live by grazing?—Yes.

A.152. The class of cattle there is very poor?—Yes. There may be areas where the cattle have not deteriorated, but taking the country generally, they have. I have been travelling in this country for 21 years, and I travel about 15,000 miles a year. Since I came to this country, I certainly think, the quality of the cattle has deteriorated. Except in parts of the Punjab, where

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you have really made an impression with your Hissar bull, you can see in all the villages they are getting worse. I have bought cattle in the Punjab since 1906 up to a year or two ago, and every year, believe me, the cattle at the Amritsar fair are getting worse and worse. Mr. Keventer told me in Poona last week that he does not go near the Punjab now. His buyer used to visit the Amritsar fair regularly in October for many years, and every year he now goes to another part. Mr. Keventer says exactly the same thing, that the quality of the animal he can get to-day is nothing like so good as the quality of those he got 25 years ago. I have spoken to Forest Officers and people in various parts of the country, and particularly the Forest Officer in Dharwar who has been there many years. The zamindar of Kangundi, who is one of the largest cattle-breeders in North Arcot, is also of the same opinion. All of them support my statement.

A.153. May not that deterioration of the cattle at the Amritsar fair be due to the fact that the people are now so prosperous that they can afford to keep their best cattle?—That may be a factor. The fair that is held 14 miles south of Rohtak I have attended twice with an interval of 16 years, and I am satisfied that there also there was a great deterioration. I bought a number of cattle on both occasions.

A.154. Is that Jahazgarh?—Yes, it is one of the biggest cattle fairs in India.

A.155. You say the people of India will not put the female of the ox to the plough?—Yes.

A.156. Is that general throughout India?—Absolutely.

A.157. It is not universal but it is general?—It is nearly universal.

A.158. Plough cattle are exempt from attachment for debt. Have you heard of cows being utilised for the plough to secure that exemption?—No.

A.159. I gather you think that at present there is no hope that private enterprise will build up pedigree herds?—No.

A.160. Are you in a position to amplify your explanation of the objections raised to the continuation of your courses here at Bangalore for co-operative students?—No, I have never been told the reasons. All that I know is the letter which you have.

A.161. When you speak of dairying, are you thinking of the keeping of cattle in order to sell their products, or for home consumption?—For both.

A.162. But they are two very different problems, are they not?—There are many variations of the dairying industry. The production and handling of milk is dairying. What you do with it afterwards is of course only one of the many details of the business.

A.163. I am thinking of the difficulty in the way of bringing into being anything approaching efficient dairying in India. You mentioned in your note the religious objections to getting rid of inferior cattle. Does not that objection also make it difficult to put into the herds better and better cows as they reach maturity?—No.

A.164. If you put a better cow in, it must displace the inferior animal?—Yes.

A.165. But if you cannot get rid of the inferior cow, you are in a difficulty?—You can in course of time. The inferior cow has got to die. What you have to do is to look to the future and see that everything that is coming on is better. There is no other way. There is no objection to doing it in that manner; it has got to be gradual.

A.166. That difficulty of the elimination of the poorer animal is a very big obstacle in the way of introducing better blood, is it not?—It is, if you want immediate results, but it is not in the long run. We are not in a position to give immediate results anyhow, generally speaking.

A.167. Have you any experience at all of milk recording by private bodies in India?—Very little. Mr. Keventer does a little of it, and also one or two private owners. One or two people do it, but it is very little.

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A.168. Do you think it is within the capacity of the ordinary cultivating class?—With a little organisation, it is.

A.169. You have not seen the milk-recording societies started by your students in the Punjab?—I went round with Mr. Strickland for two or three days. He talked with the people, and he seemed to think that it was quite a practicable proposal.

A.170. It is promising?—Yes.

A.171. *Dr. Hyder*: Does Mr. Keventer keep buffaloes or cows?—He keeps both. He keeps cows entirely at Simla, and he has a number of buffaloes at Aligarh. He buys all the milk for butter-making. He produces butter, but he buys the milk for that.

A.172. *Mr. Calvert*: With regard to this question of the drain of good milking cows to cities, do you think that is a considerable drain?—It is; it is a considerable drain, because of the fact that the number of real good milking cows in the country is so small. They only buy the best in the cities.

A.173. Do they take the best?—They do, undoubtedly.

A.174. Then they are lost for breeding purposes?—They do not breed any more.

A.175. I gather that by dual purposes you mean a fair milker and a fair draught animal?—That is so.

A.176. Of what standard as a milker are you thinking?—I should aim at a standard to commence with of 3,000 lbs. per year for a milker.

A.177. What about the draught animal?—It must be a suitable plough bullock for the district. I cannot define it more clearly than that.

A.178. In your note you say there is a great deal of inefficiency of cultivation owing to the inefficiency of the bullock?—Yes.

A. 179. Does that apply to places like the Punjab?—To parts of the Punjab it does, and to parts it does not. Round our place at Karnal the people tell me that the bullocks cannot pull the improved plough which we want them to use. Our bullocks can pull the improved plough without the slightest trouble. It applies equally to the Punjab.

A.180. Then you think you can get the milk into the Hariana, but cannot get the draught into the Sahiwal?—It is not necessary, because in the Hariana breed you have probably got a more suitable and more likely animal to work with. The Hariana, which we have, are milking wonderfully. Cows that have never been recorded before are now giving up to 3,000 or 4,000 lbs. The Hariana is a really good dual purpose animal.

A.181. The Hariana was going too much for draught?—Up to a year or two ago they paid no attention to milk.

A.182. They were breeding for the Artillery?—They were breeding for the urgent demand and they had not the staff. I believe they are getting the staff now.

A.183. They had to breed for the bullock batteries?—They did. They bred for the Army many years.

A.184. Do you think that there is much advantage to be gained from selecting suitable young stock from villages and sending them to a Government farm to be looked after in the early years?—No, I do not think it is of much use. I think it would be far better to confine one's efforts to selecting and then breeding carefully to produce pedigree.

A.185. You have got a farm at Hissar which is the biggest in India, but the number of bulls which it can turn out every year is strictly limited?—Yes, but it is to be very rapidly increased.

A.186. Have you tried selecting young animals from the villages and taking them to the farm to be well looked after?—It is not nearly so good as what they are doing at Hissar with their own cattle. They have generations of pedigree and the animals produced will be sure to be what is wanted. I have done a great deal of it myself.

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A.187. *Sir Henry Lawrence*: What are the figures of bulls turned out at Hissar?—I do not know.

Mr. Calvert: They have been turning out 300 a year, but now they are increasing that. They hope to double it shortly.

A.188. *Sir Henry Lawrence*: For your ultimate ideal of cattle in India, you would have only pedigree bulls from Government farms or from known stock?—Yes.

A.189. Gradually eliminating the whole of the scrub bulls we have got?—There is no other way to get the result.

A.190. *Mr. Kamat*: You have told the Commission that in Great Britain private enterprise was able to raise pedigree herds, and yet you say that in India it is an impossibility?—Yes.

A.191. You have also stated on page 8 of your memorandum that cattle-breeding farms in India cannot be expected to pay their way for many years to come?—Yes.

A.192. You stand by that?—I do.

A.193. I want to know how you reconcile that with your statement on page 9 with reference to the cultivator that "if he uses the right breeds and practises the correct methods, cattle-rearing and the growing and conserving of fodder crops for this purpose as a regular part of his agricultural operations will be profitable." Apparently it is not profitable for Government with all their resources and it is not profitable for the big landholder. How can it be made profitable to the small cultivator?—If you read on to the next paragraph you will see that I distinctly say that this cannot be done by the cultivator until we give him pedigree bulls. It is the evolution of the pedigree that is going to cost the money. That is what is not profitable.

A.194. The bigger landowner can get the pedigree bull?—No, I have said he cannot; it must be done by the State.

A.195. The State can get the pedigree bulls?—Yes, if it pays the money, but it must be unprofitable commercially.

A.196. And yet you say that Government cattle farms cannot pay their way?—Certainly not, as long as they are making the pedigree.

A.197. So that that is not the chief factor?—Yes, it is the one and only factor.

A.198. But I understand you to say it is not profitable for the State or for the big landowner, and yet it is likely to be profitable for the cultivator?—It will be profitable for the cultivator when we give him the pedigree. It is the manufacture of the pedigree that will be unprofitable.

A.199. Can you give me a rough idea how long it takes for the cultivator to sell his young stock, and what would be the cost of maintenance of his animal, even if you gave him the pedigree bull. Will it take three years or four years?—It all depends. In some parts of the country they sell their young stock when they are weaned. In others they rear them. In some parts they break them in as bullocks and sell them.

A.200. Till then he has to maintain his cow?—Yes, and its calf.

A.201. It is not an economic proposition; he loses every month?—Not necessarily. If he has the proper class of animal bred from a pedigree bull he will not lose; it will be a profitable business.

A.202. From the commencement?—From the commencement of the time that he gets a proper type of pedigree bull.

A.203. From the very commencement you say it will be profitable for him; that is to say, the milk yield has a value which covers his expenses?—That, of course, depends on the class of cow he is using.

A.204. Given a pedigree and the class of cow, the yield of milk covers his daily or monthly expenses. Is that so?—Well, that ought to be our aim. At the present time it does not.

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A.205. I am asking you, 'could you make that so'?—I can.

A.206. If it can be made a self-supporting business given these two things, I wonder why Government cattle farms could not also be made self-supporting?—They would, when they have got a pedigree. It is the elimination of the unfit, in order to establish a pedigree, that is going to cost the money. What are you going to do with the rejected? You start with animals that are selected. You know nothing about them from the breeding point of view. You will probably get five out of seven that are worth keeping. What is to be done with the other two? Who is to bear the loss of those that are or no use? It is the building up of the pedigree that is going to be the expensive thing, and the aim is to produce a pedigree which will make it more profitable for the cultivator.

A.207. *Mr. Calvert*: Have you seen the progress of the cow-breeding colonisation scheme in Montgomery?—I have been there.

A.208. Is it hopeful?—It is hopeful.

A.209. That is where a grant of land is given to the cultivator on condition that he maintains an approved type of cow?—I saw all the cows in the colony with Mr. Strickland, and I think it is a very good thing.

A.210. *Mr. Kamat*: You told us that in this competition of the buffalo against the cow, it is possible that the cow will eventually eliminate the buffalo. Is that right?—Yes.

A.211. How long will it take to evolve a type of cow which will give such milk as will enable her to displace the buffalo?—That depends entirely on the amount of funds and the staff which are allotted for the purpose.

A.212. Given the funds and the staff, how long will it take you to evolve a pedigree breed? Will it take three generations or four generations?—I should think there would be a very marked improvement in 25 years.

A.213. Till then the cow cannot hold her position?—She will gradually make her way. She is here now, and she should be getting better every year.

A.214. You think that the cow can eliminate the buffalo?—I believe it can, and I believe it must.

A.215. Do you think it will take 25 years?—I say it will take longer than 25 years; but there will be a marked improvement in 25 years, provided the staff and the funds allotted are adequate.

A.216. You say that the policy of the Military dairy farms was detrimental to the general interest of cattle-breeding, as it was based purely on the economic principle of getting the highest yield of milk. If this cross-breeding system is inevitable in the case of the Military dairy farms, purely from an economic point of view, will it not also be inevitable for the private cultivator who wants to go in for the dairying business?—I did not say that the policy of the Military dairy farms was detrimental to the general cattle-breeding of the country. In my opinion it has had no effect whatever on it and it has nothing to do with it. It has not affected it, nor is it likely to affect it in any way.

A.217. You do not agree with Mr. Bruen on that point?—I disagree with him most emphatically.

A.218. The prejudice against castration exists only in certain parts of the country. In other parts castration in an approved form is carried on?—Yes, by the Italian method.

A.219. You say the dairying business has a future in India. May I know then why the fate of the Anand Creamery is hanging in the balance? Is it not the fact that Government are trying to close it down because it is not a commercial proposition?—That is so.

A.220. Why is it not a commercial proposition for the Government?—Because it has been established in order to carry on investigation and to teach students. We have the full complement of students just now. There

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are no dairying educational institutions in the world that I know of that pay their way commercially.

A.221. You say in your memorandum that something could be done with butter-milk as a bye-product of milk?—A bye-product of *ghi*.

A.222. Have you published any bulletin as to what could be done with it?—I have not.

A.223. Government have not yet taken any steps to publish the results of your research?—I cannot tell you what can be done because I have not made any experiments.

A.224. You feel something could be done, but you are not in a position at the present moment to say what could be done?—I am certain it can be done.

A.225. It is a matter of research?—It is a matter of investigation. Conditions with regard to buffalo milk are so different from the conditions with cows' milk in every respect.

A.226. For the present do you know anything more than the layman knows?—No.

A.227. *Mr. Calvert*: Can dairying education of the Bangalore standard be given in any of the provincial agricultural colleges?—Not at present.

A.228. In none of them?—None of them.

A.229. So that if your education in dairying at Bangalore is closed down, there is nothing at present to replace it?—There is nothing.

A.230. *Mr. Kamat*: Do you think the manufacture of condensed milk in this country is a possibility in the near future?—Yes; we made a trial last week; we have the samples here.

A.231. You think it could be done on a commercial scale in various parts of India?—I have been asked by two of the largest provision firms in India, one of them two years ago and one quite lately, to tell them definitely whether they would be safe in investing money in India in a condensed milk plant as they are large importers and they think they can produce it much cheaper in the country. In view of this enquiry we have purchased a plant, but we have never had any funds to work it. We have had just funds enough to pay for the plant.

A.232. No experiments even on a laboratory scale have been done?—No.

A.233. *Sir Henry Lawrence*: As regards the last question, what funds are there at your disposal for your experiments?—We have had none allocated so far specially for experiments. The budget for the working of the dairy has been utilised to do what little we have done.

A.234. How much does it represent?—I shall have to get the figures. Will you permit me to give them to you later? The net sum of course is much smaller than the budget as we return most of the money we get at these farms, but I will give you the gross and net figures later.

A.235. Can you give me any estimate of the total expenditure you would like to make?—The revenue expenditure at the Bangalore, Wellington and Karnal Farms for the year ending March 1926 was 3,15,182 rupees and for the same period the receipts from these farms were 3,13,655 rupees. A detailed note of expenditure and receipts has been handed over to each Member.

A.236. *The Chairman*: The actual net expenditure is not shown?—No. The revenue expenditure generally is less than the receipts. I will send the figures to you in a statement. (Appendix II, page 47).

A.237. *Sir Henry Lawrence*: All told, the Government of India are not spending out of pocket much more than a lakh of rupees a year?—They are not spending anything like that, on revenue expenditure.

A.238. What do you consider the interests of the country in dairying and improvement of cattle are worth?—You could economically spend a crore with really good results. The Irish Free State this year are building a new dairy

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school at a cost of £49,000 and are allotting £6,000 a year to keep it up, and they have only $3\frac{1}{4}$ million people.

A.239. So that if the Government of India and the Provincial Governments were to spend some crores of rupees, it would not be money thrown away?—It certainly would not; we have got 170 million cattle in the country.

A.240. *Dr. Hyder*: Do you think one research institute would be able to cope with such a vast number of cattle?—No, I do not.

A.241. *Sir Henry Lawrence*: Would you like to increase the number of institutes throughout India to half a dozen or so?—Half a dozen would certainly not be an unreasonable figure.

A.242. Do you know anything of the progress of building up some half-bred herds in Brazil and Texas, for which Indian bulls were imported?—The best known is Mr. Borden's herd in Texas. He had Gir bulls and the cattle he now has are one-eighth Gir. They show distinctive traces of the Gir head and twisted ear in every case. They are superior to the pure European breeds in this respect that they could go further to water and come back without losing flesh. They are bred for beef entirely.

A.243. When was that experiment made?—It began I think about 20 years ago. I sent Mr. Borden his first bull in 1904. He has an eighth part left in a great many of them, but he cannot get in any more bulls. He tried very hard, but the United States Government absolutely refused to allow him. He said the Gir put on beef better than any.

A.244. Why were they not sent?—The United States Government would not allow them to go in.

A.245. A similar success has been achieved in Brazil?—In Brazil they were largely got for breeding purposes, the pure Nellore. There are two very fine herds in Brazil. We published in the *Agricultural Journal* two photographs we had procured for the purpose. There are some 1,800 head of pure Nellore in Brazil; that is in the herd of one man; it is a private venture. He sells bulls for very high prices. They use Nellore, I believe, mostly in the coffee districts and the planters use the cows for milk.

A.246. I am not quite clear about your views on the question of importing bulls and their effect in this country. You say that the second and third cross, $3\frac{1}{4}$ and $7\frac{1}{8}$, are not suitable?—No.

A.247. But the experience in Brazil and Texas is to give a cross in the first generation and then continue with other cross-breeds I think?—No, Mr. Borden continued with pure-bred bulls. He used pure Shorthorn and pure Hereford. Mr. Borden is far too clever a man to breed with cross-bred bulls. He uses nothing but the best.

A.248. But then he does not keep on with the Gir bull?—He cannot; he would like to do it very much, but they will not allow him to bring them in. The last lot that arrived for him there were, I believe, slaughtered at Washington.

A.249. Then there is no lesson to be drawn from these Brazil and Texas experiments that is of any value to this country?—No. In Brazil, as far as I know, they have kept the Indian breeds pure. In fact the finest Nellore cattle in the world are undoubtedly found in Cuba and Brazil to-day.

A.250. The losses from rinderpest are very severe in this country?—They are.

A.251. To what extent can it be rightly said that the local cattle are immune from rinderpest?—Some are more immune than others, but all of them, except the hill cattle, have a very high degree of natural immunity.

A.252. But how do you reconcile that with the loss from rinderpest?—If they did not have that degree of natural immunity, the loss would be 90 per cent. Probably it is not more than 25 per cent. In the Military dairies before the days of simultaneous inoculation we never lost more than 30 per cent. In one lot of Aden cows we lost the whole lot; they died like flies; they had no natural immunity.

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A.253. You mentioned in answer to the Chairman that you regard heredity as one of the important factors in the improvement of cattle?—Yes.

A.254. Is it not the primary factor?—It is.

A.255. I thought you regarded it as one of the minor factors?—Pedigree means that you have the force of heredity.

A.256. *The Chairman*: The witness's point was that heredity is an important factor in resistance to disease?—Yes, it is. That, as proved with the half-breds, is a Mendelian factor. Some of them carry a high degree of immunity to rinderpest, and some of them have no immunity at all.

A.257. *Sir Henry Lawrence*: Amongst the good breeds that can be improved for milk you mentioned the Deccani. I was not quite sure what breed you had in mind. Were you referring to the Krishna Valley cattle?—No. Krishna Valley cattle are the Nellore cattle. I was referring to the Dangi cattle. They are black and white. They breed wonderfully pure. You get them all round Belgaum.

A.258. What do you mean by Deccani?—They are generally called in that district Deccani cattle. They call it Dangi.

A.259. Then, you said that Mr. Keventer was sending milk from Aligarh to Delhi. What distance is it?—It is about 100 miles.

A.260. What do you regard as the best system for the production of milk for Bombay?—Production in the fields in a rural area where you can get all the fodder you need, pasteurisation, and railing it into Bombay. I regard that as the system for all Indian cities.

A.261. Do you know of any particular difficulty in the way of having successful dairies established outside Bombay?—None, except the one great difficulty which strikes at the root of this question of urban milk-supply, the want of protection against impure produce. That is the principal difficulty.

A.262. *Mr. Calvert*: Bad milk drives out good milk?—It is not so much that, but the respectable business man will not invest his money in the dairy industry if he has to compete against every kind of white liquid sold as milk. It is unfair competition and the risk is too great for the capitalist to undertake.

A.263. *Sir Henry Lawrence*: What you draw attention to is the necessity of improving the protection of the purchaser of milk in the cities?—Yes, and of the vendor. The protection of the vendor from the point of view of the dairy trade is really the important thing. The honest vendor now has no chance.

A.264. There are regulations, but they are not enforced?—Yes, standards have been fixed and everything else.

A.265. *Professor Gangulee*: Are they not being enforced in Calcutta now?—Not very well. The Municipality have given half a lakh of rupees to a co-operative society, and that society is going ahead very well because they are selling pure milk, but they complain bitterly of the competition they have to meet.

A.266. *Mr. Keventer* sells milk in Calcutta and he has good milk?—The quantity of milk he sells is very small. He does not come to the commercial scale. He has the gilt-edged trade which you can get in any community at a very high price.

A.267. *Sir Ganga Ram*: Have you published any pamphlet or book containing the names of the fodders you have experimented on?—I have not experimented on any fodders.

A.268. You say you have experimented on different kinds of fodder?—No, that is Mr. Warth.

A.269. Do the Military Department generally make butter from buffalo milk?—They always make it from buffalo milk.

A.270. What is the difference between buffalo milk and cow's milk?—The proportion of fat in the milk of the class of cows that the Military dairy farms

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use may be taken as 4.25 per cent on an average; the percentage of fat in the milk of the buffalo is usually 7.75.

A.271. Is there any physical or scientific objection to the male buffalo being used for draught purposes?—The general experience is, he will not work in the heat which is the time when you want him to work. I have tried him myself in farms under my charge.

A.272. Is he used for drawing carts?—He is a bit slow, but the worst objection is that he lies down when it gets a little hot.

A.273. As far as you know there is no religious objection?—None whatever.

A.274. *Dr. Hyder*: You stated that the buffalo will not work in the heat. Do you know the hours of ploughing in different parts of the country? Do they not begin ploughing at 5 in the morning and finish up by 10 A.M. and plough again in the afternoon after the heat has subsided? If that is so, the question of employing the male buffalo in the heat does not arise?—The buffalo is too slow, and the chief thing for the cultivator is speed. He gets the rain, and he has to get on with his cultivation or it is too late.

A.275. Is that so in the Mysore State?—Yes. He ploughs all day round about here in the season.

A.276. *Sir Thomas Middleton*: Can you give us any idea of the number of pedigree bulls now being produced by the different farms in India?—I cannot say.

A.277. Approximately is it 500 or 5,000?—I cannot say.

A.278. Can you tell us how these bulls are tested? I understand they have short pedigree?—Yes.

A.279. How are they tested? Are they tested at all before being sent out?—The test applied is of course the general size, utility and power of movement.

A.280. Is the quality of their progeny followed up by inspecting officers?—In some instances it is, but generally it is not.

A.281. Can you give me any idea at all as to the number of misfits among these bulls that are sent out?—Amongst the bulls sent out from the Punjab farm, which is the biggest, I do not think there are many. They are very careful about sending them out; there is nothing sent out that is not good; they are not sent out until they are mature. Outside the Punjab comparatively few pedigree bulls have been sent out so far.

A.282. Your scheme is to supply Government pedigree bulls for all the cows of India?—Yes, eventually.

A.283. How many pedigree bulls would you want?—A million. You have got 44 million adult cows, and at the rate of 1 bull for every 50 cows, you need a million bulls.

A.284. I do not know whether you have considered any time table for your scheme or whether you have contemplated a process of 20 or 30 years' development?—It is hardly in the nature of a scheme yet so far as I am concerned. I have only put down the ideal that has to be attained. We have not had the temerity to go into a scheme as yet.

A.285. Would you agree with me that to reach that ideal it would take many years?—It certainly would.

A.286. Would it be measured by years or centuries?—By years. It has a cumulative effect, you see. Every bull you get out is good for 50 cows per year. I am thinking of what has been done in Ireland since they started the premium bull system. They have revolutionised the cattle in the south of Ireland in 20 years.

A.287. I can remember what the cattle of Ireland were 40 years ago and I know them now, and I recognise that they have revolutionised the cattle there. But the Irish had a stock to draw upon which had been bred for 150 years?—Yes. They drew upon England. They had a pedigree to draw upon, but we have not got that.

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A.288. I have been thinking of the improvement in Ireland and I have been asking myself how long it would take to have a similar change accomplished in India with no pedigree stock to draw upon?—I have never thought of the point. However long it is going to be, it has got to be done.

A.289. I think you will have to reckon in centuries and not in years?—I hope not.

A.290. You take rather a pessimistic view of private enterprise. You think it is hopeless to expect private enterprise to do anything?—So far it has been so in India.

A.291. Because it is unprofitable?—Yes, you see the rejection question is so difficult. Everybody I have talked to about it has asked me, "What are we going to do with the unfit?"

A.292. Was it hope of profit that encouraged private enterprise in England?—Yes.

A.293. How many landowners in England made profits out of cattle-breeding?—It was the tenant farmer who developed cattle-breeding in England.

A.294. He bought the cattle?—Yes.

A.295. But who bred them?—He bred them himself. Most of the great breeders that I have known were tenant farmers. There was Mr. William Duthie of Collynie. Where would you find a more public-spirited man, and look at the vast fortune he left as the result of this work.

A.296. But if you will look through the history of pedigree breeding in England and in Scotland I think you will find that landowners and private enterprise were at work for a very long time before the tenant farmer began to take up pedigree breeding?—The landowner was at work, but would you not admit it was a profitable thing for him? He was a public-spirited man no doubt, he wanted to make his tenants more successful; he felt that this was too big a job for them in the beginning and so he took it up; but in the end it was profitable for him. It was certainly profitable for his tenants, and that meant he would get his share in the end.

A.297. If you apply ordinary profit and loss methods to the account of landowners you would seldom show a profit on pedigree breeding?—I am not acquainted with that aspect of it.

A.298. It was private enterprise that made the stock of Great Britain?—But is not private enterprise in all countries actuated by a desire for profit?

A.299. *The Chairman*: Or public spirit?—The enterprises of most of the business men I have met aimed at making money in the end.

A.300. *Sir Thomas Middleton*: It was from that point of view, that I thought perhaps you were taking a narrow view of the possibilities of private enterprise among the landowners of India?—Probably I am not sufficiently acquainted with the subject, but that was my opinion. The men whom I have personally known, most of whom have been in Scotland, were tenant farmers who were interested in cattle-breeding and they made money on it.

A.301. Some of them do. I could mention some who do and some who do not?—I think I am correct. I think they did make a profit.

A.302. To go to the other end of the scale of breeders, I think you are a little too hard upon the *Rabari* of Gujarat. You put down the lack of improvement in Indian cattle mainly to the ignorance of the cattle-breeder and you mentioned in an answer in that connection that the *Rabari* was now a fodder thief. I find, however, that you have a good impression of their knowledge of stock. Do they not care for their stock?—They probably care for the stock, but they cannot get sufficient fodder.

A.303. Is that not an excuse for them becoming fodder thieves?—But it does not contribute to the improvement of the cattle.

A.304. It keeps the cattle alive?—It would be better if they were dead, if they cannot be properly fed.

A.305. That brings me to the next point, the question of fodder. I think on page 12 you sum up the position in a way with which I agree. You say

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this question will only be solved when it can be made profitable for the cultivator to rear cattle?—That is what we have got to aim at. We are trying to make it profitable.

A.306. What amount of produce would you require, in your opinion, to make the rearing of a cow profitable?—Two thousand five hundred pounds of milk a year per cow.

A.307. You will agree that the actual yield would vary very widely in different parts of India. 2,000 lbs. might be profitable in one part of India, while 3,000 lbs. would be required in another part?—The conditions would affect it of course.

A.308. What is the root condition?—The root condition is the quality of the animal, its capacity for producing milk. It is the degree of efficiency of the milk-producing machine, namely, the cow.

A.309. In connection with your point that the cultivator must go in for growing food, would the cost of production of his fodder be an important factor?—I have always contended that the shoe is rather on the other foot. He will not grow fodder, because the animal to which he has to feed it does not produce anything in return. That is what I have seen in this country at the shows where I have judged. You will always find in big areas like Central India, the bullocks that produce a return for their food are fat as butter, but the cows are not fit to be looked at. The cultivators say, "What does the cow give us in return?"

A.310. That is just the question I was going to ask you. Supposing a cultivator puts you that question in some particular tract, you would be able to say to him, "Well, a cow that yields you 2,000 lbs. brings you nothing, but a cow yielding 2,500 lbs. yields a profit"?—Yes, there would be something in that.

A.311. *Sir Ganga Ram*. What about the manure?—They say they keep them for manure.

A.312. There ought to be some credit given for the manure he gets?—You do not mean to say that the manure that the animal gives is sufficient return for his food?

A.313. No, but when you say that it gives no return you have to take that into consideration?—It is of value.

A.314. *Sir Thomas Middleton*. After that limit is reached, we will call it 2,500 lbs., the profit increases very rapidly?—The ratio goes up very rapidly.

A.315. Have you in any case issued information or bulletins showing how the rate of profit rises with the increase in the yield of milk?—I have not.

A.316. Has that been done in India to any extent?—I have not seen it.

A.317. The attention of the cultivator has not been drawn to what one may call the marginal limit in milk production and the rapid increase of profit after that margin has been passed?—I think not.

A.318. Now, we have been talking a great deal about the bull, but have said very little about the Indian cow so far, except to condemn her milk-yielding qualities. Is it not your experience that even among the Indian cows there is a very large individual variation?—Yes.

A.319. If you went into a district, such as any of those you have named, where there are good cattle, and were to select 100 cows, what percentage of those which you bought by inspection would you expect to turn out really profitable cows?—I have never bought any cows for these farms that were not profitable. All of them have been profitable.

A.320. That is pretty good testimony to the average quality?—Yes, but you could get very few, and in some districts you could not get any that were really worth buying from that point of view.

A.321. You mentioned in reply to *Sir Henry Lawrence* the Gir cattle. What sort of percentage would you expect with that breed?—You would probably get about 20 per cent of them pretty good, but there are a very small number of them left, and what is left are fairly good.

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A.322. It happens that 20 per cent. is the percentage I got when I secured a herd of the Gir breed many years ago?—Yes, but you can hardly get them at all; it would take you three weeks to pick up a dozen.

A.323. If you were buying in Sind or in any other district where the cows are good, what sort of percentage would you expect to get?—I could pick up in Sind as many as I want, all good. I bought 3,680 for the Military dairies in Sind in 2½ years during the war and practically every one of them was good.

A.324. Can you give us some idea of the variation of yield?—2,500 lbs. to 5,000 lbs.

A.325. One would call a cow yielding 2,500 lbs. a good cow?—Yes, but Sind is an exception; you can still get plenty of good cows in Sind, but there is no other place that I know of in India where you can do that.

A.326. *Sir Henry Lawrence*: Any Karachi breeds?—Of the 3,680, there were about 250 of the Thar Parkar breed, and all the others were red Sindhi or Karachi breed.

A.327. *Sir Thomas Middleton*: In most districts in India, one could still find a small percentage; the quality remains in the individual cows in most districts; does it not?—No, not in many districts. In North Arcot I was judging at a show last year; there was not an animal in the show that we would have bought.

A.328. Not an animal giving more than 1,500 lbs.?—There was no animal giving 1,000 lbs.

A.329. On page 7 you set out the problems that you would like to take up?—Yes.

A.330. These are not arranged in any order of merit, are they?—Not particularly; I think myself that No. 1 is certainly the most important.

A.331. There is an enormous demand for *ghi* in the country?—Yes, and an extraordinary amount of adulteration takes place in connection with *ghi*.

A.332. The errors in the manufacture of *ghi* are mostly wilful. People know how to manufacture *ghi* very well, if they wish to?—Throughout the country they adopt one method; there is very little variation; my own opinion is that it is a very wasteful method.

A.333. *Dr. Hyder*: Have you ever seen Kashmere *ghi*?—I have seen it on the market.

A.334. Does it smell?—It smells high.

A.335. *Sir Thomas Middleton*: I understand that for sometime there was a large trade in casein in Gujarat?—There was.

A.336. What has become of that trade?—There is very little done now. It has such a bad name that the people in London will not buy it, or at least they do not look for it. It is too much adulterated, and it contains fat and rice meal very often, always butter fat; it is not properly washed out.

A.337. You mentioned that you have been consulted with reference to laws that were introduced in three Municipalities?—Yes, the three Municipalities wrote to us at one time or another.

A.338. What percentages of butter fat in milk are stipulated?—5 per cent for buffalo's milk I think, in all three cases, and 3.25 per cent for cow's milk as the standard minimum; 8½ per cent solids, not fat, in both cases.

A.339. You had a sufficient number of analyses at your disposal to enable you to fix these standards without much difficulty?—We had no difficulty at all; we had plenty of material; you see, they wanted a standard that would be within a safe limit.

A.340. *Professor Gangulee*: You test butter fat by the Babcock method?—By the Gerber method; it is the simpler method. The Babcock method is used in America, but it is the same principle.

A.341. *Sir Thomas Middleton*: I gather from your replies to other questions that the difficulty is not your lack of knowledge as to what the milk

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ought to contain nor is it due to the absence of legislation, but to the lack of enforcement of legislation?—That is so.

A.342. Do any prosecutions take place?—Yes, there are a few which take place in all places.

A.343. Are the fines negligible?—No; I do not know what they are now. They are not too low; they are fairly severe.

A.344. Is there imprisonment for repeated offences?—No; no imprisonment.

A.345. With reference to the incidence of rinderpest, can you say from your own knowledge whether rinderpest attacks the weakest cattle on the grazings, or whether it attacks indiscriminately the better kept and the poorer animals as well?—I think our experience of rinderpest on the Military dairy farms is that it attacks the poorest, and those that are in bad health are more likely to be attacked than the others.

A.346. You argue that there are far too many cattle in India, and therefore rinderpest may not always be an unmitigated evil?—Unfortunately, as the years go by, of course they gain a greater degree of immunity to rinderpest. Every generation is a little more resistant than the other.

A.347. *Professor Gangulee*: Your pure breeds are comparatively immune from rinderpest?—No; most of them are not immune, but we get some which have an immunity, which is evidently a Mendelian character.

A.348. *Dr. Hyder*: You say that your charge is the whole of India, including Burma. I want to know whether that is a small charge or a big charge?—It is a big one.

A.349. You think there is room for provincial institutes?—There certainly is.

A.350. Is yours a research institute, or what?—We have done practically no research so far. It is educational up to the present, and experimental to some degree.

A.351. It is only an educational institute, you say?—Yes.

A.352. You give a Diploma course?—Yes; we take also post-graduate students and short course students.

A.353. You admit there is room for many more such institutes in all the Provinces in India?—I think there is.

A.354. You have mentioned some of these problems which are awaiting investigation?—Yes.

A.355. Do you not think any one of these problems is enough to occupy the lifetime of one man?—It would certainly occupy a great deal of his time if he went to the end of it; there is no end of course in that sort of thing.

A.356. I suppose you would admit that behind these problems there are other problems connected with fodder and things of that sort?—Yes. You see, in regard to these problems it would not take a very long time to get sufficient information to be able to give the data to the country and indicate which is the best method of doing this or that, and which is the best method of avoiding loss in doing it. For instance, this throwing away of the by-products of *ghi* must mean an extraordinary loss to the country.

A.357. You refer to the butter-milk; do you not?—Yes.

A.358. Is not that drunk largely by the peasants?—In some parts it is; at certain times of the year when milk is scarce they drink it; at other times when milk is plentiful it is partly thrown away.

A.359. My experience of the Punjab is that in the winter season they make it into some sort of soup and they drink it in large quantities. Is that so?—Yes.

A.360. Are there other parts of the Empire in which such research people are investigating these problems?—No. There is no part of the Empire where they are investigating the problem of the treatment of the milk of the buffalo. It is the milk of the buffalo that we have to deal with now. *Ghi* is nearly always made from the milk of the buffalo.

A.361. I think your great problem is to evolve dual purpose breeds?—Yes; we must deal with the conditions as we have them.

A.362. Do you think you can get any assistance from such workers in other parts of the Empire?—No; we have to deal with these problems on our own; our conditions are different.

A.363. Can you get any help from Australia or Canada?—We get all the information they can give; but the particular question we have to tackle here is the question of buffalo milk. All the literature that we get from them refers to cows' milk.

A.364. Take the question of storage?—That is a tropical question. There is very little done under tropical dairying in any part of the world. Most of the great dairying countries that have gone ahead have been in more or less temperate climates.

A.365. *Sir Thomas Middleton*: With regard to dried milk, it is to be an investigation of the costs, I take it?—Costs and methods.

A.366. You would not use a drying roll?—It all depends. I should try the vacuum roll. I think we should get the best results here by spraying the milk into a hot chamber. There was a factory which worked on that system in Gujarat for a while, but it was allowed to fall to pieces after the war. They made a lot of it which sold very well in Europe.

A.367. The investigations are mainly of a commercial kind; you want to go into costs?—Costs and methods, and find out also what kind of stuff we can produce for the world's market. Our casein nobody will buy.

A.368. *Sir Ganga Ram*: Is there a milk factory in Mysore?—I understand Sir Alfred Chatterton is going to do something; but he has not done anything yet. There was one started in Gujarat. They put up a magnificent plant, but never made a tin of condensed milk.

A.369. *Professor Gangulee*: What are your views regarding the export of cattle?—I think myself we should encourage it for all we are worth. That is the one thing that will bring home to our people the value of pedigree. It will raise the value of cattle. A lot of Sindhi cattle are exported now; a small export trade takes place now.

A.370. You would not put a stop to it?—Certainly not.

A.371. You do not think that is a drain on the country?—No; not at all.

A.372. *Dr. Hyder*: Is this export trade in livestock or in meat?—In livestock.

A.373. You think it is a large volume?—No, it is a very small volume; it will be well to increase it.

A.374. *The Chairman*: Do you think the export of pedigree animals from Great Britain has been the chief cause of the improvement of the cattle in Great Britain?—I do, and in Holland.

A.375. *Professor Gangulee*: You said you would not have legislation with regard to the spread of cattle disease?—Not at present.

A.376. Have you any idea what effectual steps could be taken for the control of infectious disease?—The only effective step would be restriction on movement; but we cannot do that until you have an organisation fit to enforce it.

A.377. You must create an organisation?—Yes, you must have your organisation first, so that when you pass legislation it will not be a farce.

A.378. You suggest that you would like to have a number of dairy institutes all over the country?—I said there was room for them.

A.379. In the event of your having these dairy institutes all over the country, would you have them one in each Province, or would you divide the country according to the so-called dairy tracts?—As a matter of fact, the major Provinces, I think, would start one each; the smaller Provinces would probably utilise that belonging to their nearest major Province.

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A.380. You would keep in view administrative units and not suitable dairy tracts?—I think myself that the whole country requires dairy produce, and it all requires cows. In the backward districts it is more important.

A.381. I was speaking of areas where the conditions might be favourable?—I do not think there is any part of India that could afford not to develop the dairy business, not only from the cattle point of view but from the point of view of the well-being of the people.

A.382. In England one should certainly have dairy institutes in Norfolk or Suffolk. But the National Institute of Dairying is located at Reading?—You are dealing with a very much more confined area there.

A.383. Gujarat, as you say, has very favourable conditions for dairying. Would you not like to have an institute there?—That is why I am so anxious to keep this factory there.

A.384. It would be desirable to have an institute in Bengal?—Yes.

A.385. If you had these dairy institutes, who would be the controlling agent? Would it be the Government?—If they were provincial, I take it, as things are now, they would be controlled by the Provincial Government.

A.386. If you establish a dairy institute on the basis I suggest you could get better advantages. Then it would not be in the jurisdiction of any particular Province?—It might not be; it might be run by the Central Government, and run with great advantage, I believe.

A.387. Then you would have, for example, a number of institutes just like this Institute of Dairying under the guidance and control of the Central Government?—It would be a good thing, I think.

A.388. *Mr. Calvert*: Do you think you could produce a dual purpose animal for the whole of India, or would you find difficulties invariably in the sub-montane and montane areas where you have these little terraced fields for which a very compact animal is required? Does that mean that you cannot get a dual purpose animal?—I see no reason why the dam of that bullock should not give a reasonable quantity of milk.

A.389. What about your rejection of the Dhunni breed?—I took an opportunity of studying that breed; I think we could introduce milk into it.

A.390. A dual purpose policy could not be extended throughout?—It could.

A.391. *Sir James MacKenna*: Have you attended the meetings of the Board of Agriculture?—Yes, since 1909.

A.392. What do you think about the scope and utility of that body? Can it be made more useful than at present?—I think it served a very useful purpose, a very great purpose indeed. I have enjoyed the meetings so much and obtained great assistance and benefit from them. I think it might be extended with benefit to the country very largely. It is the only point at which the members of the Indian Agricultural Service have an opportunity of meeting one another and of getting new ideas and of having their own ideas criticised. I say that the Board of Agriculture has done great work for agriculture in India, and I should be sorry indeed if it were dropped. I believe it could be extended and enlarged, to the benefit of the country.

A.393. Have you any suggestions to make in that respect?—I think myself that it could be enlarged as a general Board, that is, a Central Department, working through expert executive committees. That ought to make it less unwieldy, and probably take up a little less time.

A.394. *Sir Henry Lawrence*: You have mentioned one point on which you disagreed with the views and opinions expressed by Mr. Bruen. Are there any other points in Mr. Bruen's evidence which you think it necessary to explain or say something about?—There is one point. He stated that if the Military dairy farms had done at every farm what they have done at Ferozepore, and built up a pure Indian herd at each farm, as they have done at Ferozepore, the result would have been the same to them; meaning thereby, I take it, that we would have had their milk equally cheap and in addition have been able to contribute largely to the cattle-breeding policy of this coun-

try. I entirely disagree with that. To begin with, the Ferozepore herd was founded by taking the best cattle from all the herds in India, and that could only be done once. Secondly, Mr. Bruen quoted the fact that the average yield of the present herds at Ferozepore was practically as high as that of some of the cross-bred herds. That may be so, but it has taken 17 or 18 years to bring it to that point, and you had this equally high yield from the cross-breds in about 4 years, so that in the intervening period between the 4th and the 17th years the Military dairies would have lost a very large sum of money in the production of milk. That is a point on which I disagree with him.

A.395. Are there any other points of importance on which you disagree with Mr. Bruen?—I again entirely disagree with the statement made by Mr. Bruen that half-bred bulls sold or otherwise distributed by the Military Farms Department in India have injured the quality of Indian cattle and have introduced diseases amongst them. As a matter of fact practically no uncastrated cross-bred males were issued or sold by the Military Farms Department and very few cross-bred cattle of any kind were disposed of to the public by the Military Farms Department during the 15 years of my service with them, so much so that it is quite impossible that the few animals sold to the public could make any impression whatever on either the health or the quality of the cattle of India.

A.396. With regard to the milk-supply for cities, are you satisfied with the facilities which the railways give for the carriage of milk to cities?—My experience of the railways has been really very good. In War time, we sent enormous quantities of milk. We sent milk from Jubbulpore to Bombay and sold it there. I found the railways were very ready to meet us. They generally arranged a special rate, especially the Bombay, Baroda and Central India Railway.

A.397. Do you think they will meet the private producer in the same way?—I could not say. They put a special van on the Bombay, Baroda and Central India Railway to enable us to send milk to Bombay; we could only guarantee the traffic up to the end of the War.

A.398. Is it in existence now?—I do not know. We did not do it after the War.

A.399. *The Chairman:* You have mentioned the desire on the part of foreign countries to import into those countries the best native breeds. Have you looked round the tropical world to see whether you could find any animals which may improve the Indian breeds?—I have never had the opportunity of visiting the tropical world to see for myself. From all I can learn from correspondence, we have been carrying on correspondence for a great many years, they have nothing as good as we have.

A.400. How about Ceylon?—They use Sindhi cows very largely. There is a regular business there in Sindhi cows. I have myself bought some cows for the Government of Ceylon and shipped them. I had been to Ceylon last year, and I found they had very poor cattle.

A.401. Are you devoting any time to the improvement of the buffalo as a milk-yielding animal?—We have on our farm a small herd at Karnal, and we have a few here; but you can buy in the open market. If you go to the right place, you can buy good buffaloes to-day. That is not the present problem.

A.402. Is the practice of sending she-buffaloes in milk to, for instance, Bombay, milking them until they dry, and thereafter selling them, having a bad effect on the breeds?—It is done systematically and regularly. I do not think it has had a very serious effect on the breed.

A.403. Do you think it may have that effect in time?—I doubt it; it is hardly big enough to affect it.

A.404. Mr. Bruen told us that the difference in the melting point between the butter of the buffalo and that of the cow is a practical factor in its popularity?—Mr. Plymen, the Director of Agriculture in the Central Provinces,

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when he was Agricultural Chemist to that Government, made some very careful investigations into the subject, and he found that the melting point varied of course at different seasons of the year, from 7 to 9 degrees Fahrenheit. He published a pamphlet on the subject, which is available.

A.405. Which has the higher melting point, the butter of the buffalo or of the cow?—That of the buffalo is higher; it stands up much better to the heat.

A.406. Which is the better for cooking purposes?—That of the buffalo is better.

A.407. To revert to the question of draught animals, is hardness of the feet a very important quality of the draught animal?—It is an important quality.

A.408. Are you watching it here?—As a matter of fact, in our crossing experiments in the Military farms, we have not paid any attention to draught whatever. In the selection of cattle for dual purposes here, we have paid particular attention to the feet, but we have not had any trouble. The breeds that we have taken up have good hard feet.

A.409. Is it the case that in parts of the country which are hard and stony, they evolve an animal with very hard feet?—I think it would naturally be so. I have not found that the Sindhi, which has been bred in the northern part of India, has any better feet than the Hariana of the Punjab. They are both shod of course when they come to work.

A.410. At the very end of your memorandum you make a complaint against the Railway Companies, because they charge for the calves running with the dams at the same rate as they do for cows themselves?—They do so for passenger trains.

A.411. Have you ever made a complaint about it?—I took the matter up with the Government of India; Dr. Clouston took it up with the authorities; the correspondence lasted for a year and a half, but nothing came of it.

A.412. What did they say?—They said those were the rules, and they refused to give a refund. On a goods train, you may have your calves that are under 2½ feet high at the shoulder free, but by passenger train you have to pay the full charge for the calf. And according to their own rules not more than 8 can be put in a wagon, yet they put 16 in a wagon, including the calves.

A.413. Do you get an impression, from your long experience of India, that, taking one thing with another, the rural population is anxious for an improvement in the cattle-breeds?—I think they are, the better class of them. The poorer class breeder in the jungle tracts is really too ignorant; he is too much of a jungli to understand what it means, I think. But the breeder of the future must, I think, be the cultivator; he is certainly ready for the scheme, would welcome it, and would assist in bringing it about.

(The witness withdrew.)

APPENDIX I.

A.—Principal dual purpose breeds (types) of cattle (non-buffalo), in India.

<i>Name of breed.</i>	<i>Habitat.</i>
Sindhi	Western Sind.
Thar Parkar	South-eastern Sind.
Haryana or Hansi Hissar	South-eastern Punjab and parts of the United Provinces.
Ongole or Nellore	Guntur district of Madras.
Kankrej	Gujarat district of the Bombay Presidency.
Gir	Kathiawar and parts of Baroda State.
Krishna Valley	These are Nellore cattle bred in the Krishna Valley district in the Bombay Presidency.

B.—Principal single purpose breeds (types) of cattle (non-buffalo), in India.

Sahiwal (Montgomery)	Milk, Central Punjab.
Dhunni	Draught, Northern Punjab.
Bhagnari	Draught, Baluchistan and Northern Sind.
Kheri	Draught, Northern United Provinces.
Malvi	Draught, Central India.
Nimari	Draught, Central Provinces.
Khillari	Draught, Khandesh and North-eastern Bombay.
Dangi	Draught, Southern Maharatta country and hilly tracts of the Deccan.
Amrit Mahal	Draught, Mysore, South-eastern Bombay and parts of Madras.
Kangyam	Draught, Central Madras,
Burmese	Draught, Burma.

APPENDIX II.

Statement showing the Expenditure and Receipts of the three Farms at Bangalore, Wellington and Karnal and of the Office of Imperial Dairy Expert for the last three years.

	1923-24. For 9 months only (July— March).			1924-25.			1925-26.		
	Total revenue expendi- ture.	Total receipts.	Capital expendi- ture.	Total revenue expendi- ture.	Total receipts.	Capital expendi- ture.	Total revenue expendi- ture.	Total receipts.	Capital expendi- ture.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Imperial Institute of Animal Husbandry and Dairying, Ban- galore.	1,09,840	1,17,599	58,093	1,55,294	1,76,001	34,740	1,41,380	1,51,391	32,460
Imperial Government Dairy Farm, Wellington.	58,714	70,312	15,975	79,109	86,408	8,918	87,785	83,913	18,195
Imperial Government Cattle-breed- ing Farm, Karnal.	27,014	75,211	77,947	68,079	71,918	44,371	86,017	78,351	28,407
TOTAL	1,95,568	2,63,122	1,52,015	3,02,482	3,34,327	88,029	3,15,182	3,13,655	79,062
Office of Imperial Dairy Expert	46,585	...	...	38,392	...	...	43,531	...	...

Mr. F. J. WARTH, Physiological Chemist, Bangalore.

Memorandum on the Animal Nutrition Section, Bangalore.

1. *History of the Animal Nutrition Section.*—The New Section dealing with Nutrition was started by me on October 24th, 1921, at Pusa. The initial work consisted in training a staff, testing methods of analysis, methods of sampling and the entire routine for digestion experiments. Trial stalls were set up and tested for their suitability in this country. After this preliminary work, land was procured and levelled, digestion stalls with the necessary adjuncts were constructed, and a series of digestion experiments was undertaken. A new form of nitrogen metabolism apparatus was devised by me at this time. The apparatus, which has been described in the *Agricultural Journal of India* (Volume XVIII, Part 3), was put into operation at Pusa and yielded some very interesting results. It was found, for instance, that the Bihar bullock maintained a nitrogen balance with a remarkably low proportion of protein in his ration. These and other results emphasised the need for studying the applicability of European standard rations to Indian cattle. The results of one year's work at Pusa were that preliminary tests had been completed, a temporary but efficient block of nutrition buildings had been set up, a satisfactory routine for digestion work had been established, and experiments were proceeding without a break. In addition to this the new nitrogen metabolism apparatus was in operation almost continuously. Some of the results obtained with rice straw in this early work were published in the *Agricultural Journal of India* (Volume XVIII, Part 5). Digestion experiments were also carried out with a number of concentrates from Government Military Dairies. I went on leave in April 1923 and Mr. A. V. Iyer, First Assistant to the Physiological Chemist, took over charge. The work proceeded smoothly until July 2nd when orders were received to transfer the Section to Bangalore. The transfer was effected efficiently and promptly by Mr. Iyer and on my return to duty in November 1923, I was posted direct to Bangalore. It became evident on my arrival that, if anything, the transfer had been too prompt. There was no laboratory and there were no stalls. The proposed laboratory was inadequate. Fresh plans were prepared and construction of the laboratory and stalls pressed forward. By great exertions and by working in half fitted rooms chemical analysis was commenced at Bangalore in July 1924. The transfer had, therefore, cost the Section exactly one year.

2. The following is the working accommodation provided at Bangalore for the Nutrition Section:—

- (a) A chemical laboratory fitted up in a building which was originally a dairy store house. It includes a lecture room for the Dairy Diploma students, a store room and office rooms occupying 1,632·8 square feet. The laboratory rooms proper occupy 2,421 square feet.
- (b) A new cattle shed occupying 1,200 square feet, specially constructed for nutrition experiments.
- (c) Specially constructed store and preparation rooms occupying 900 square feet, for nutrition work, and adjoining the nutrition shed.
- (d) A weighbridge brought from Pusa and housed in a specially constructed shed.
- (e) A petrol gas plant in a small room specially built to accommodate it.

Last year a small extension was added to the laboratory and this year a barn and cattle shed have been sanctioned.

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3. *Staff*.—The Physiological Chemist's staff consists of:—

One Senior Assistant, Class II Service.

Three Junior Assistants.

One Fieldman.

One Clerk.

4. *The present system of recruiting staff on long-term agreements*.—I have been fortunate in my staff. Every man has worked loyally. Without devoted service it would not have been possible to carry out the immense amount of work which has been done in such a short time. In considering terms of recruitment it is my opinion that assured employment and definite prospects for good work will bring us more suitable men than we can hope to get in any other way. The primary selection must naturally be done carefully and the probationary period must be long enough to serve the intended purpose. Prospects of promotion on the one hand and the loss of increments on the other ought to be sufficient incentives generally to maintain efficiency in the service. There will be black sheep at times, but on the whole I would prefer to have a staff of permanent men interested in their vocation and their institution and assured of steady employment and advancement.

5. *The work of the Section at Bangalore*.—In commencing the study of Animal Nutrition in India the first question which had to be considered was what lines of work should be taken up. Some of the problems which have been met in other parts of the world are undoubtedly important in India. One of these, the mineral problem has been taken up without hesitation as certain to lead to useful results. There are also problems which are peculiar to the country and the climate. A few of these are obvious. There can be no doubt, for instance, that the coarse fodders require investigation. But we have no assurance that the obvious problems include the most vital. Hence the second question arises. How are the real needs of the country to be tracked down systematically? This can only be done by carrying out numerous feeding tests and procuring first-hand knowledge of the nutritive effect of all kinds of Indian foodstuffs. Experience with a wide range of materials and data for comparative purposes will reveal the requirements. The guiding principle at Bangalore is, therefore, the collection of wide experience. The Section has carried out as many feeding tests as possible wherever and whenever an opportunity offered. The tests have been done invariably with a definite limited object in view and corresponding definite information has been gained; but there has been always behind these tests the general idea of a search for more fundamental problems. It will be seen, in what follows, that the procedure has been completely justified. Already at this early stage of the work matters of wide significance are emerging from these initial experiments. The Section made a start at Bangalore in July 1924, when the laboratory was able to commence analyses. The lines of work which have been developed since that date are described under the following heads.

(a) *The testing of feeding standards*.—As nothing whatever was known about our foodstuffs the first experiments undertaken at Bangalore were tests to determine the applicability of European and American standard rations to this country. Tests dealing with milk production and the growth of heifers have been carried to a conclusion. The results have been prepared for publication and will be issued shortly as *Memoirs of the Department of Agriculture*. The main facts elucidated so far may be condensed into a few words. It was found that the American digestion data could not be applied without modification to our rations. The experiment with our cross-bred cows showed that they were slightly more efficient in the utilisation of food than pure-bred American cows. The higher efficiency is accounted for by a better digestion of fibre.

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Eckles in America has shown that the energy value of the milk produced by a cow is greater than the net energy of the food available for milk production, i.e., food is more economically used for milk production than for maintenance or growth. The Bangalore tests confirm and amplify this conclusion. The figures of Eckles in America and the Bangalore results are shown together in the accompanying chart [Appendix III (a)]. The work on milk production necessitated a large number of milk analyses. The accompanying graph [Appendix III (b)] shows how closely the Bangalore Dairy milk corresponds to average figures from America. Experiments on growing heifers showed that our cross-bred animals required somewhat more net energy for growth than is allowed by Armsby's standard. Compared with the Wolf Lehmann standard they utilised the standard amount of crude protein and somewhat less than the standard amount of total nutrients. The long series of valuable digestion data obtained in the course of these experiments cannot be quoted here. More work on Sindhi cattle remains to be done.

(b) *The rationing of young stock.*—The work with young stock is important for a number of reasons. Considering first the animals themselves—they have not developed their digestive systems and require special food on this account. Then the food should be of such a nature that it will act favourably upon the development of a good digestive system. Finally the young growing animal requires relatively speaking an enormous amount of nutrient to support the demands for growth. This must be provided by the food in suitable form and proportions. Economically the feeding of unsuitable or insufficient food results in very serious loss. It involves a great waste of foodstuffs on unproductive maintenance, a waste of the animal's capacity to utilise food productively and a waste of health or ability to resist disease. In studying foodstuffs the young animal is especially useful. The demands for growth being more rigorous than the demands for maintenance, the shortcomings of a foodstuff tell more quickly and more decisively with young stock. For these reasons the Nutrition Section is constantly increasing its work on young stock.

An interesting and useful experiment with calves was concluded four months ago at Bangalore. The animals were divided into three groups receiving different types of concentrates which contained, respectively, A13.9 per cent, B26.9 per cent, C30.3 per cent, protein. The quantities fed were so selected that the net energy provided by the concentrates A and B were equal whilst the protein content of B was much higher. Ration C provided more protein but less net energy than rations A. Roughage was given *ad lib*. The amounts of concentrates fed and the growth obtained are shown in the following table.

TABLE 1.—Showing amounts of concentrate given and live weight increases obtained.

	Ration A.	Ration B.	Ration C.
Total concentrate fed per 1000 lbs. live weight.	21.3 lbs.	16.0 lbs.	10.7 lbs.
Protein supplied in concentrate per 1000 lbs. live weight	2.97 „	4.31 „	3.25 „
Net Energy supplied in concentrate per 1000 lbs. live weight	11.49 „	11.49 „	10.70 „
	Therms.	Therms.	Therms.
Average daily increase per 1000 lbs. live weight	5.72 lbs.	5.43 lbs.	4.39 lbs.

The figures show that with these rations growth is not proportionate to the protein but runs more nearly parallel to the net energy of the concentrate. The fate of the food protein is shown in the following data obtained from a nitrogen balance experiment with six of the calves.

TABLE 2.—Nitrogen balance experiment with six calves.

Grams per day.	Ration A.		Ration B.		Ration C.	
	Calf 1.	Calf 2.	Calf 3.	Calf 4.	Calf 5.	Calf 6
Total Protein Nitrogen in ration	53.42	56.50	95.05	68.60	78.14	55.77
Nitrogen digested	32.88	34.22	67.33	49.36	51.84	36.01
Nitrogen excreted in urine . . .	14.23	13.36	48.66	30.31	35.00	24.02
Nitrogen retained for flesh formation	18.65	20.86	18.67	19.05	15.94	11.99

In ration A the amount of nitrogen digested is low but excretory losses are also very low and hence the balance retained is satisfactory. In ration C the amount of nitrogen digested per 1000 lbs. live weight is much higher but the retention is less perfect. In these experiments, as already stated, roughage was provided *ad lib*, but the actual amount consumed daily by each animal was accurately determined. The roughage consumption together with other significant figures is given in the following table:—

TABLE 3.—Average daily consumption of dry matter in lbs. per 1000 lbs live weight.

	Average Live weight lbs.	Daily increase per 1000 lbs. Live weight. lbs.	Food consumed per 1000 lbs. live weight.			Amount of roughage to 1 of concentrate.	Per cent. digestion of ration.
			Rough- age.	Concen- trate.	Total.		
A Ration	218	5.72	10.83	16.25	27.08	.781	59.8
B Ration	217	5.43	13.02	13.06	26.08	1.130	60.6
C Ration	207	4.39	14.84	8.68	23.52	1.899	60.0

This table contains important information. The figures show in the first place, as was to be expected, that high allowance of concentrate is accompanied by low consumption of roughage and *vice versa*, that the highest total consumption occurs when concentrate is high and that the live weight increases run parallel with the total consumption. The last fact is especially significant. It appears that the total amount of organic matter digested and the percentage digestion are very important measures of the actual value of a ration, and that the proportion of protein may vary within wide limits without influencing the rate of growth. The actual quantities of food consumed and growth obtained in this experiment are expected to be valuable guides to the practical dairy cattle feeder in this country. The results in such feeding tests however depend very much upon the nature of the roughages employed. More experiments on these and similar lines are required to determine suitable concentrate allowances for the various roughages. It is proposed to deal with this subject more systematically when the entire Bangalore Dairy herd can be exploited for experimental purposes. That the roughage (sorghum silage) used in the above experiment was of high quality is shown by the figures in the two last columns. The digestion attained remained at the same level when the proportion of roughage was more than doubled. The experiment is finally of interest in showing what can be accomplished with ordinary Indian foodstuffs. A consumption of 27 lbs. of dry matter per 1,000 lbs. live weight by Indian stock weighing 200 lbs. is good, and the growth obtained, over a pound a day per head for a period of 100 days, is encouraging. It should be mentioned, however, that all the animals referred to in this experiment received a mineral supplement to their ration. This point will be dealt with later.

(c) *Indian coarse fodders*.—Under this head it is intended to carry out a systematic study of the chief Indian roughages. We possess a certain amount of information concerning our concentrates. We can assign fairly definite

food values to very many of them. With the Indian roughages the situation is altogether different. We do not know the elementary facts regarding their digestibility, energy value or other characteristics. Further, as the roughage forms the bulk of the ration, malnutrition and nutritional diseases almost invariably arise from deficiencies in the roughage. The enquiry on coarse fodders is, therefore, an urgent matter. The tests which have been adopted for this work at Bangalore are rigorous and searching. The experimental animals are kept on the ration for a long period and at different stages of the feeding tests digestion experiments and nitrogen metabolism experiments are carried out.

The first series of tests were made with rice straw and Indian baled hay. The experiment came to an end recently and has yielded most interesting information. Accurate digestion data have been procured and the net energy values of the two roughages have been determined indirectly. It was found that our rice straw has a decidedly higher net energy value than that assigned to the American product. The hay was inferior to average American hay.

These figures will be of the greatest use for rationing purposes, and, in fact, the Military Dairy Farms department has specifically asked the Nutrition Section for information which these figures provide. At the last Board of Agriculture meeting at Pusa an informal meeting between the officers of the Military Dairy Farms and the Physiological Chemist took place. The latter asked what information the Military Dairy Farms needed most of all and was told that information on maintenance rations was urgently required. Recently, also, in a private communication, Lieutenant-Colonel Matson, Assistant Controller of Military Dairy Farms, said that above everything they wished to know the effective values of rice straw, hay, wheat straw and *juar*. As the maintenance ration is calculated directly from the net energy value of a foodstuff and the effective value is the net energy value, the Nutrition Section has been able to supply the desired information promptly. The fact is the experiments which provided the information were commenced ten months before the query came, which shows that the Section had selected appropriate work.

The information gleaned from this experiment does not end here. In the course of the work a remarkable physiological effect due to rice straw was discovered. It was found that rice straw produces persistent diuresis, and the cause of this diuresis was traced to the high potash content of the straw. The animal is obliged to get rid of the excessive intake of this base. The figures in the following table taken from a paper recently submitted for publication by the Nutrition Section bring out these facts clearly.

TABLE 4.—Average excretion of urine and potash by animals fed on rice straw and hay respectively.

		1000 lbs. animals		750 lbs. animals.		500 lbs. animals.	
		No. 1	No. 2	No. 1	No. 2	No. 1	No. 2
		Straw.	Hay.	Straw.	Hay.	Straw.	Hay.
Average daily urine excretion in kilos—							
1st test.	Apr. 1925	7·871	3·947	7·797	3·665	6·299	3·219
2nd test.	Sep. 1925	6·830	2·842	5·877	3·021	4·968	3·141
3rd test.	Nov. 1925	7·572	3·329	7·223	3·338	5·745	2·563
Average		7·424	3·373	6·966	3·341	5·671	2·974
Average daily potash excretion in urine in gms.—							
1st test.	Apr. 1925	92·50	33·14	83·77	27·11	61·43	20·14
2nd test.	Sep. 1925	100·30	31·50	92·20	26·30	67·13	21·52
3rd test.	Nov. 1925	130·58	33·50	119·53	31·27	90·07	22·21
Average		107·79	32·71	98·50	28·23	72·88	21·29

It is impossible to say, at present, what the effect of this diuresis will be. Up to a point the elimination of urine is a healthy symptom. It may be expected to clear the system. On the other hand, the excretion of very large amounts of urine, or of urine of abnormal reaction, is a strain on the kidneys and must inevitably lead to serious results.

That the urinary excretion may be profoundly affected by the nature of the roughage consumed, is, therefore, a discovery of great significance. It is possible that a subject of fundamental importance to animal nutrition in India has been met with here. The question is being followed up tentatively at present. In the first place a circular letter has been sent to the Provinces asking for samples of typical rice straw from all parts of India and Burma. Secondly, pending the arrival and arrangement of this material, the diuretic effect of other roughages has been studied. Ranges of variations in urinary excretion have been observed which exceed the above-noted difference between rice straw and hay. For example, the figures for the average daily excretion produced by two roughages recently examined were found to be 2.50 and 15.55 kilos, respectively.

The systematic examination of Indian roughages is proceeding. A second series of tests, on a somewhat larger scale, with more bullocks and intended to deal with four new roughages has been commenced. The intention in this work is to add steadily to its utility and scientific significance by increasing the number and nature of the observations made during the long period of feeding. Some clinical tests will be introduced this year and eventually it is intended to do respiration experiments with these animals.

(d) *Mineral requirements.*—Recent work in Europe has shown that the productive capacity of an otherwise sufficient ration may be completely lost through inadequacy of the mineral supply, and conversely it has been found that the addition of appropriate minerals in such cases greatly enhances the productive capacity of the food. It is impossible to lay too much stress on this question in India. Mineral shortage is common and it must lead to a waste of the potential nutritive power of the organic matter produced by plant growth. Experiments on mineral supplements required for growing stock have been commenced at Bangalore. The test with calves, mentioned above, was used mainly to decide on suitable rations for this purpose. A comparative test was, however, carried out concurrently, a check lot being fed on the same rations, but without a mineral supplement. There was a marked and consistent difference between the controls and the lime-fed lot in favour of lime feeding but stress is not laid on this preliminary result at present. Appropriate rations having been fixed, a more extensive experiment focussed solely on the mineral question has been started. The subject of mineral supplements was, however, deemed of such importance that efforts were made to amplify the work at Bangalore by using outside resources. For this purpose preliminary experiments have been carried through at Hosur (the Central Cattle Breeding Station of the Madras Department of Agriculture) and plans are ready for a trial there during the coming season. A somewhat different experiment relating to the same subject has been proposed to the Military Dairy Farms. The proposal has been accepted and the work will commence as soon as this Section can spare the necessary staff. In the preliminary experiment at Hosur mineral tests were not attempted. A simple feeding experiment to compare hay and grass silage was carried out in order to study the conditions of work there. Thanks to the facilities given to this Section by my friend Mr. R. W. Littlewood, Deputy Director of Agriculture, Livestock, Madras, the effort has been an unqualified success. The results obtained in the first Hosur experiment, though they do not deal directly with the mineral question, deserve notice. Sixteen animals were selected for the experiment. They were carefully paired and divided into two groups. The one group was given hay, the other silage. A weighed excess of roughage was fed to each animal and the residue left by each was weighed

daily. Both groups received the same amount of concentrate, namely, one pound cake and 2 lbs. rice bran per head. The animals themselves were weighed daily during the entire experimental period which lasted 13 weeks. The main results obtained can be shown in a condensed form. The following figures give the changes in live weight which took place during the feeding period.

	Silage group.	Hay group.
Final average live weight per head lbs. .	514	471
Initial average live weight per head lbs. .	485	474
	<hr/>	<hr/>
Average increase per head lbs. .	+29	-3

There can be no doubt that the silage was more effective than the hay. To give force to these figures it should be observed that the average live weight per head is taken from the weekly average live weights of 8 animals. Each figure in the table is, therefore, derived from 56 live weight determinations. The first impression from these figures is that silage is far more nutritious than hay. This is not the case. They are probably about equally nutritious. The difference in effect is entirely accounted for by the quantities consumed. The average consumption of dry matter from roughage per head per day was found to be:

for the Silage group	8'363 lbs.
for the Hay group	5'860 lbs.

These are striking and important figures. This experiment has yielded much valuable information. It has shown in the first place that a productive ration cannot be obtained from spear grass hay. The animals consume just enough to maintain themselves. In the second place, it has shown the advantage of converting spear grass into silage. The silage is probably not more nutritious but it is consumed more readily and in amounts above the maintenance requirement. Hence it becomes a productive ration. The hay fed for 13 weeks—together with concentrate be it noted—gave no return whatever. The economics of cattle-rearing are beautifully illustrated by these figures. The experiment has also yielded material from which the nutritive values of the roughages can be determined. The necessary analyses for this purpose however have not been completed yet.

Finally it has to be noted that the rate of live weight increase even with the silage is far from satisfactory. Further experiments are being arranged to investigate this point.

To be fair to the work of this Section the figures for average dry matter consumption per head given above must be referred to once more. They are the figures that have elucidated the real meaning of silage efficiency. These two figures for dry matter consumption are the result of an enormous amount of work. Not only was the ration and residue of each animal determined daily for a period of 13 weeks, but the daily variations in moisture content of the hay and silage had to be allowed for, and in addition to this the partial drying up of the silage while it lay in the trough had to be taken into account daily. To carry out a test of this kind entails labour and demands a great deal of organisation. It is work which can only be done by trained men and a trained staff. In this case, too, it was done at an outstation and not at headquarters. The Section should have more men for dealing with work of this kind.

(e) *Indian pasture grasses.*—This work follows along the lines of the most recent observations upon pasture land which have been made in England. Here again the Section has been fortunate in finding outside support. A large amount of work including analyses, digestion experiments and long period feeding tests is in progress at Bangalore on material supplied by the Military Grass Farms. The Bombay Department of Agriculture has taken a

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great deal of interest in its pasture problem for many years past. The Nutrition Section, having approached the Bombay Department, is to be provided very shortly with most valuable material from this part of the country. Finally on the strength of the Hosur feeding experiments, already referred to, the Director of Agriculture, Madras, has agreed to the necessity for laying down new grass at Hosur. This is a most important experiment which will eventually provide further material for crucial tests by the Nutrition Section. The work on pasture grasses is particularly important because recent work in England has shown that there is a real prospect of increasing productivity in this direction in India. The work outlined above aims mainly at a determination of the variations in quality which are to be expected. The next step must be an attempt to obtain higher productivity from definite areas which the present experiments are expected to locate for us. This work will involve careful feeding experiments carried out on the spot. The Nutrition Section must have the staff and organisation ready for this approaching task.

(f) *Work in the Provinces.*—Work in the Provinces is undertaken for the following reasons:—

1. To get in touch with local nutrition problems and conditions.
2. To amplify the work at Bangalore.
3. To test foodstuffs which cannot be conveniently tested here.

Most of the work under this head has been referred to already in connection with the special subjects. An experiment carried out at the Imperial Cattle Breeding Farm, Karnal, which has not been mentioned so far, deserves to be noticed here. The experiment was designed to test the value of different local coarse fodders for winter rationing of calves. The calves were divided into 4 lots receiving, respectively, *dhub* hay, rice straw, sorghum straw and wheat straw, *ad lib.* Concentrate was given in equal amounts to all the animals. Live weights were determined daily and the quantity of roughage consumed by each calf was also determined every day. The results obtained in this long period test covering 120 days are given in a highly condensed form in the following table:—

Ration.	Average live weight per head.	Average weight increase per head.	Average daily roughage consumed.
	Lbs.	Lbs.	Lbs.
Hay	301	·31	5·58
Rice straw	297	·61	6·96
Sorghum straw	300	·57	5·74
Wheat straw	297	·41	5·44

It should be observed that each live weight figure is the average of 42 weighings of 5 animals. Each figure for live weight increase is the average difference between two sets of 21st weighings of 5 animals. The roughage consumption was determined for each animal for 120 days. The figures show that rice straw was most greedily consumed and gave the highest live weight increase. This result is contrary to local opinion which holds that wheat straw is preferable, and the preference is so strong that the local price of wheat straw is four times that of rice straw. A fact of considerable economic significance has been arrived at here. The sorghum may have been somewhat too tough for such young animals and might conceivably show much better results with older stock. The hay result is certainly remarkable. That rice straw should give better results than *dhub* hay, which is believed to be one of the most nutritious grasses in India, is a matter deserving attention. It is noteworthy that these experiments were carried out during the three

coldest months of the year. There is a possibility, therefore, that we have found a fodder which is particularly suitable for the cold season. The point has cropped up by chance, but there is no doubt that if we can recommend special rationing to help the animals through the months of intense cold a very important result will have been achieved. Experiments to test the possibilities in this direction are being prepared. To sum up the results of the first series of tests at Karnal, they have yielded firstly information of economic value which the active Superintendent of that Farm is already making use of; secondly, they have indicated lines for further enquiry one of which has been discussed above.

With regard to all the work in the Provinces one point requires to be noticed. The Section has so organized the plan of procedure to be employed that we are ready to carry out feeding tests in any part of the country. Some time ago the Section carried out a digestion experiment with perfect success at Karnal in the Punjab. More recently a very elaborate feeding test, with 16 calves, a digestion experiment with 8 animals and a nitrogen metabolism experiment with the same 8 animals was carried out without a single hitch by the Section at Hosur in the Madras Presidency.

(g) *Training of Post-Graduate students in Animal Nutrition.*—This work was taken up by the Section voluntarily. It is a valuable means for disseminating a knowledge of, and an interest in, animal nutrition throughout the Provinces. The course of training which covers one year includes:—

1. An advanced lecture course on animal nutrition.

2. The planning and carrying out a nutrition experiment under the direction of the Physiological Chemist.

3. The study of all nutrition experiments in progress here.

The work is thoroughly practical. The students have to handle and care for the animals in their charge and have to study their feeding capacity and rationing. Seven students have completed the course up to date.

(h) *Assistance given by the Nutrition Section to the Section of the Imperial Dairy Expert.*—1. Courses of lectures on Chemistry (by an Assistant in the Nutrition Section) and on animal nutrition (by the Physiological Chemist personally) were provided for the Dairy Diploma students.

2. The Imperial Dairy Expert asked for a practical procedure for accurate cream neutralisation in connection with pasteurisation. The Nutrition Section carried out an investigation of the question. A practical process was evolved and handed over to the dairy in a workable form.

3. A question relating to cheese-making has recently been submitted to this Section. At present preliminary enquiries are being made.

I would like to record here my deep appreciation of the wholehearted support which my friend Mr. William Smith, Imperial Dairy Expert, has invariably given to this Section, and often it has been given at considerable inconvenience to himself.

6. *Advisory work for Provincial Departments.*—Applications for advice have been received from the Director of Agriculture, Bihar and Orissa, and from the Military Dairy Farms regarding mineral supplements. The required information was supplied. Detailed plans for feeding experiments have been prepared for the Madras and Mysore Departments of Agriculture. The Military Dairy Farms specially asked for information on maintenance rations. One set of results obtained at Bangalore has been provided. Further figures will become available from work which is proceeding now. Questions from the United Provinces relating to the digestibility of certain foodstuffs were replied to. Assistance given to the Imperial Dairy Expert has been mentioned in another place.

7. *Publication.*—The work of publication has just commenced. The results of the first year's experiments (1924) have been embodied in two

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Memoirs which are in the press. The completed experiments of 1925-26 will form four Memoirs, but the writing up of this work is only half done. The subjects dealt with are:—

1. Nutrients required for milk production with Indian foodstuffs.
2. Nutrients required for growth production with Indian foodstuffs.
3. Bangalore maintenance experiments, 1st series.
4. Calf feeding experiments at Bangalore in 1925.
5. The relative feeding values of hay and grass silage, Hosur experiments, 1925-26.
6. Roughages for winter feeding of young stock in the Punjab, Karnal experiments, 1925-26.

The following articles have been submitted for publication in the *Agricultural Journal*:—

1. The application of feeding standards to dairy cattle in India.
2. Factors influencing the cost of food for milk production.
3. The relationship between digestibility and net energy values.

8. *Provision for training men for the highest post in the department.*—This Section provides such a training in the Post-Graduate course already referred to, but so far no students have come who could be trained to this extent. Some of the students were altogether unsuitable, owing to inadequate previous education. I will consider only the case of the best men we have had. They were a fine type. They had character and personality, they were gentlemen and my relations with them have been intimate and cordial. It has been a real pleasure to me to have had them here. With regard to their work I can say that they applied themselves to it with zeal and enthusiasm and some of them devoted themselves to it. I must also add that I consider almost all of them fully appreciated and grasped the significance of the work and the possibilities it opened out. They left Bangalore with a sound knowledge of the principles of animal nutrition. But when I am asked whether the men were fit for the highest posts in this subject in the department I have to say definitely—No. Men taking a Post-Graduate course in animal nutrition might be expected to fill a post of:—

1. Animal Nutrition Expert.
2. Cattle Expert or Dairy Expert.
3. Deputy Director of Agriculture.

To become a Nutrition Expert it is essential to have specialised in Chemistry at least. The man who takes up this work must be able to guide the ordinary laboratory processes and deal with the chemical problems which arise. Not one of the men who came here had received the necessary education in Chemistry, not one of them was in a position to discuss procedures with an apprentice in the laboratory. They had received a good general scientific education up to the Intermediate standard, but the final 18 months of study devoted to one or two major subjects had been entirely omitted. My contention is that no amount of post-graduate technical training can make up for this want of scientific training. The point is well illustrated by the case of the man who has not had a chemical training. He may do post-graduate work on animal nutrition for years and yet he will not be qualified to undertake the duties of a Nutrition Specialist. It should be emphasised that the Nutrition Section cannot undertake the additional task of teaching chemistry—for which purpose the Universities exist. It is not for me to say what special qualifications a man should possess to become a Cattle Expert, a Dairy Expert or a Deputy Director of Agriculture, but the modified animal nutrition course which my post-graduate students went through would be of the greatest help to them in any one of these posts. The Nutrition Section feels that this

thoroughly practical course should be recommended and should be taken advantage of because there is a real need to disseminate interest in animal nutrition throughout the country.

9. *Short courses of lectures on special subjects.*—The Section provides a course of lectures on special subjects for the Dairy Diploma students. These lectures, however, constitute a systematic course and not what is usually understood by the term short course. This course of lectures is mentioned elsewhere.

The Physiological Chemist has also given a course of popular lectures on animal nutrition to officers of the Co-operative Departments. The lectures were combined with demonstrations and dealt mainly with the nutrition problems which are being investigated here. The officers who attended these lectures showed great interest in the work and asked many questions.

10. *Co-operation with other departments.*—During the first year of work at Bangalore (1924) the Section was fully engaged in getting its own experiments started. Tentative efforts were, however, initiated for co-operative experiments. Proposals were made to the Madras and Mysore Departments of Agriculture for feeding tests to be carried out at Coimbatore and Rayankere, respectively. Detailed instructions were given. For the former scheme the Nutrition Section merely advocated a trial and gave advice. In the latter scheme the Nutrition Section took a more active part, undertaking all the analyses and the supervision of a digestion experiment. These preliminary efforts were not successful. In one case, feeding instructions were not properly observed, in the other case, the food-supply ran out because the department in question preferred to test a roughage of which the supply was limited rather than the one recommended by the Nutrition Section. The experiments nevertheless served a purpose in showing these departments that such work was likely to be useful. The departments named are contemplating further tests at these stations. During the second year (1925) the Section was in a better position to co-operate with other departments. The initiative in all the co-operative schemes which have been inaugurated during the past year has invariably been taken by the Nutrition Section. The co-operative experiments, which constitute a large fraction of the activities of the Section, have been described already under various heads. It will suffice here to give a list of them.

List of co-operative experiments initiated by the Nutrition Section during 1925-26.

(1) *Madras Department of Agriculture.*—(a) Feeding experiments at Hosur. The cattle, the foods and the accommodation are provided by the Madras Department. The work, including a long period quantitative feeding test, a digestion experiment and analysis, are done by the Nutrition Section.

(b) Grass experiments at Hosur. The necessity for this work was urged by the Nutrition Section. The first part will be carried out by the Madras Department. The Nutrition Section will institute tests at a later stage.

(2) *Bombay Department of Agriculture.*—(a) The Nutrition Section proposed an examination of grazing area herbage. The Bombay Department Committee on pasture problems readily agreed to co-operate in this work.

(b) Requests have been made by the Joint Director, Bombay, to the Nutrition Section to carry out certain feeding tests. The Section unfortunately could not undertake the tests this year owing to shortage of staff and very great pressure of other work. It is hoped to meet the wishes of the Bombay Department next year in this matter.

(3) *Military Grass Farms and Military Dairy Farms.*—(a) Examination of Indian huy. The work includes analyses of types, digestion trials with types and long period feeding tests with types. The Nutrition Section

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carries out all the work at Bangalore. The material is supplied free of charge by the Military Grass Farms. I must acknowledge the zeal with which the Military Grass Farms have taken up the enquiry. Every question is promptly and fully considered; every request is immediately met.

(b) Feeding experiment at Jubbulpore. This work has not been commenced owing to shortage of staff.

(4) *Imperial Cattle-breeding Farm, Karnal*.—The experiments designed by the Nutrition Section for Karnal were ably carried out by the Superintendent of the Farm. The digestion experiments and the analytical work were done by the Nutrition Section. The Nutrition Section is very greatly indebted to the Agricultural Adviser, Dr. Clouston, for the financial assistance which he gave for this work.

11. *Obstacles*.—(a) The distance of the dairy from residential areas is a very serious drawback to the work. The average distance covered by every man working in the Nutrition Section from the Physiological Chemist down to the humblest menial is 7 miles a day. My men have worked splendidly in spite of this great disadvantage, but the strain is telling on them; there is constant illness and work is falling off. Quarters are required on the spot to remedy the state of affairs.

(b) The cross-breeding principles on which milk production at Bangalore is based are an endless trouble to the Nutrition Section. The Dairy only wants half-bred cows. No other stock is of any use. The procedure is that a number of country cows are brought with calf at heel. The cows have been spoilt before they arrive. They will not drop their milk without being suckled. Consequently neither the calf nor its dam is available for experiment. The next lot of calves are half-bred, but the trouble with the mothers persists and the situation remains unchanged. The half-bred cows are excellent in every way. They can be milked without trouble and are available for experimental purposes, but their offspring are useless mongrels which the Dairy sells as soon as possible. Recently I wanted 32 calves for an experiment. Only 8 could be provided out of the large herd. Both Karnal and Hosur have been able to provide as much stock as the Nutrition Section could use. It ought to be made quite clear that there has been no lack of good will on the part of the Dairy, and indeed only good will is to be expected seeing that the Nutrition Section saves the Dairy a certain amount of trouble and expense and generally hands back greatly improved stock. There is no lack of good will but there is a serious lack of material. The remedy is to put the Dairy on an experimental basis, which would enable it to breed and select country stock. To take up this work, I consider, a man with special qualifications would have to be put in charge of the herd.

(c) The Nutrition Section should have a few acres of land for growing crops. The need for this has not been absolutely essential up to the present, but it is likely to become more urgent as to the work progresses.

(d) Reference has only been made to such obstacles as are interfering with work actually in hand. For further development other obstacles would have to be dealt with.

APPENDIX I.

Statement showing sanctioned staff of the Physiological Chemist, the Imperial Institute of Animal Husbandry and Dairying, Bangalore.

Staff.	1921-22.	1922-23.	1923-24.	1924-25.	1925-26.
1. <i>Superior staff—</i>					
Physiological Chemist .	1	1	1	1	1
2. <i>Subordinate and Gazetted Provincial Officers—</i>					
First Assistant to the Physiological Chemist.	1	1	1	1	1
Laboratory Assistants .	2	2	3	3	3
Fieldman	1	1	1	1	1
Clerk . . . . .	...	1	1	1	1
3. <i>Inferior staff—</i>					
Laboratory servant. .	1	1	1	1	1
Peons	3	3	3	3	3

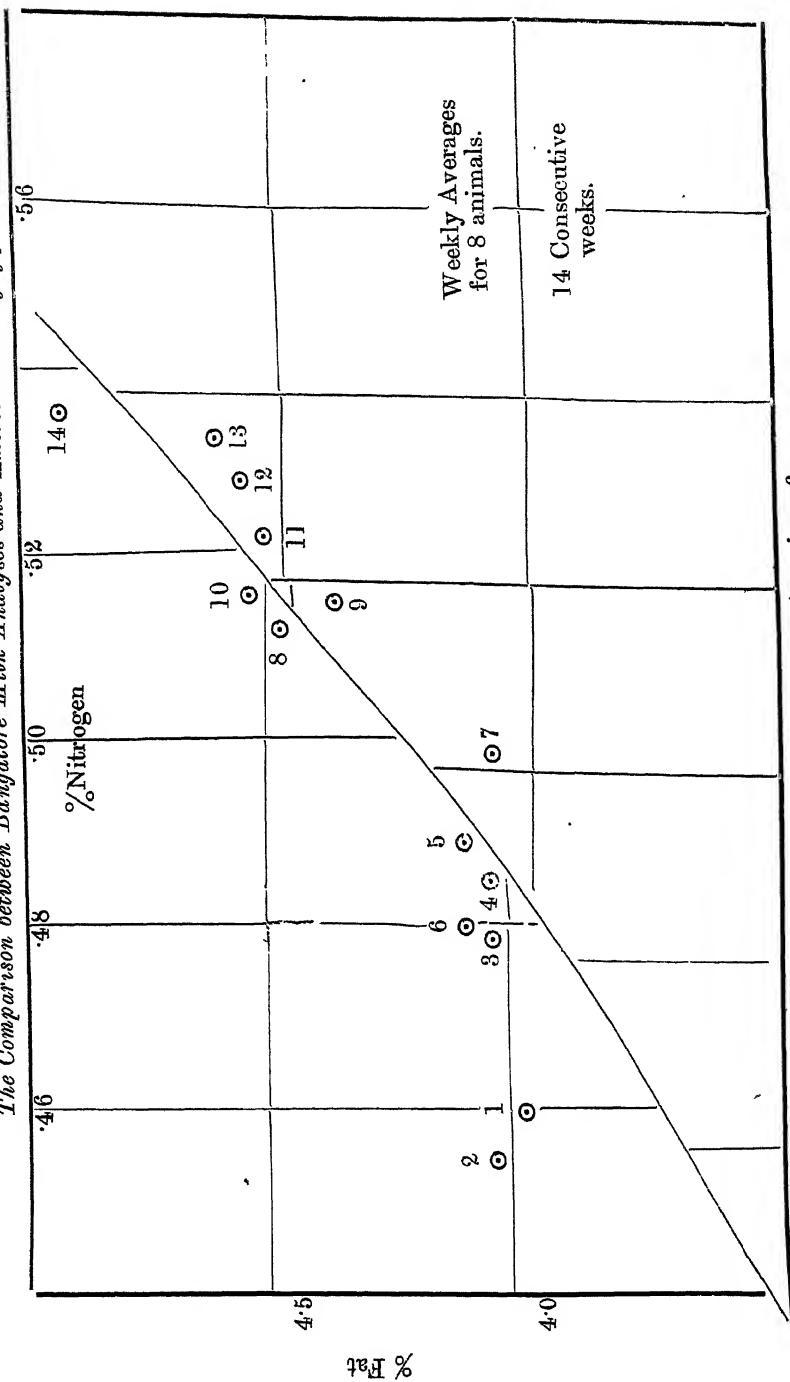
APPENDIX II.

*Statement showing the Expenditure and Receipts of the Physiological Chemist,
the Imperial Institute of Animal Husbandry and Dairying, Bangalore.*

								Rs.	A.	P.
Expenditure—										
1921-22	.	.	.	.	.	.	.	21,114	0	0
1922-23	.	.	.	.	.	.	.	38,479	0	0
1923-24	.	.	.	.	.	.	.	52,499	3	6
1924-25	.	.	.	.	.	.	.	51,838	4	11
1925-26	.	.	.	.	.	.	.	46,069	13	7
Receipts	.	.	.	.	.	.	.	Nil.		

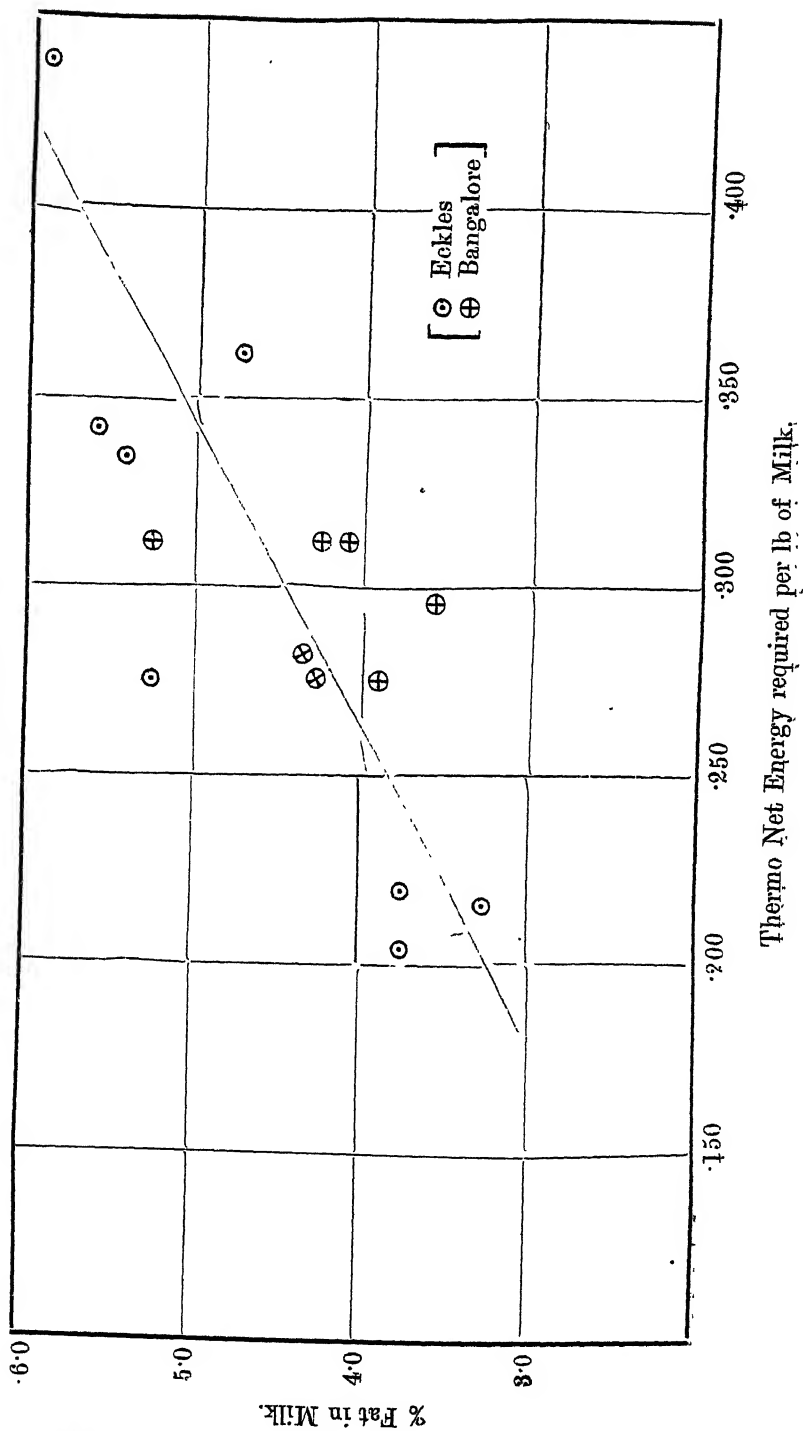
APPENDIX III (a).

The Comparison between Bangalore Milk Analyses and American Average figures.



The continuous line represents American figures.

APPENDIX III (b).



Replies to the Questionnaire.

QUESTIONS 1 (a) AND 4 (a).—CO-ORDINATION OF RESEARCH AND ADMINISTRATION.—Considerable changes have taken place in the work of the Agricultural Departments in India during the last few years. The amount of work being done has increased rapidly. The scope of the work has become very much wider. All the Provinces are rapidly providing themselves with facilities in every branch of science which is needed for furthering agricultural research. While the work is increasing the contact between the different Provinces is decreasing. Co-ordination has made no progress. I believe that very great advantages may be obtained by co-ordination and I am in entire agreement with the scheme outlined by Dr. Clouston for bringing about co-ordinated effort. In favour of co-ordination we have the following facts:—

1. However perfect the facilities provided may be, every Province will have features of its own and will be able to help other Provinces in some lines.

2. It is not economical for every Province to work for itself only. There are many enquiries which can be carried out in one place and will yield information applicable to the whole country. For example, the effect of a common foodstuff upon milk production need not be tested independently all over the country. Carefully planned tests carried out at one dairy will yield information for all the dairies.

3. There are questions which cannot be adequately dealt with in one institution. The data required may be so numerous that several institutions must combine together to procure the required information. Some important questions on milk production which will be described later, would come under this category.

4. There are some questions which can be dealt with most economically and conveniently by a Central Institute. The net energy values (Starch Equivalents) of foodstuffs, for example, must be studied at a Central Institute, and the work done there must be arranged by consultation so that the requirements of the different Provinces and tracts are given due weight.

5. Comparative studies of foodstuffs such as the Nutrition Section of the Imperial Department of Agriculture has instituted required co-operation between the Imperial and Provincial Departments of Agriculture. Such comparative work is of the highest importance not only for gauging the potentialities and deficiencies of foodstuffs, but also for determining the capabilities of different breeds of cattle. The Nutrition Section has already noted remarkable differences between Indian and cross-bred cattle in the course of such work. Co-operation with the Provinces is sure to yield more information. This is a class of work in which a Central Institute is essential.

In all these cases we require joint consideration of the problems and a systematic distribution of effort. Other branches of agricultural research should undoubtedly be dealt with in the same way.

Dr. Clouston's scheme for effecting co-ordination.—I would like to make some remarks on Dr. Clouston's proposals.

1. The Advisory Council for Agriculture in India. This Council would function more or less on the lines of the Council in England. It would not be concerned directly with the activities of the Provincial Departments of Agriculture but it would be kept in close touch with the work through provincial representation on the Council and would arrange for the execution of co-ordinated work with the Provinces. The primary duty of the Council would be to keep in touch with the progress of agricultural research through Committees of Experts. The members of the Committees would not be drawn from the Council but each Committee would be adequately represented on the Council. The second function of the Council would be to consider and endorse the recommendations of its committee and to take the necessary steps for having the work carried out. To effect this the Council must be strong and representative. It must also possess ample funds and must be able to call upon the staff of the Imperial Department for assistance.

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2. *Institutions under the Government of India.*—Well-staffed and well-equipped specialised institutions under the Central Government are required for carrying out co-ordinated enquiries in co-operation with the Provinces (the functions of the Nutrition Section in this connection have been exemplified above). These institutions may also be called upon to provide experts and expert assistance to the Provinces engaged in co-ordinated work. The present institutions under the Government of India will require considerable expansion to meet these demands. Instead of a Dairy Section and a Nutrition Section larger separate institutions for these subjects are required.

3. *The Committees* nominated by the Council will form the backbone of co-ordinating enterprise. Success in the scheme will depend entirely upon the work done by the committees. They must be given every encouragement and support. I strongly urge the formation of a committee to deal with animal nutrition. The nutrition problems of India are too serious and too diverse to be dealt with as a side issue.

QUESTION 1 (b).—Progress in Research on Animal Nutrition is seriously hindered in a number of ways:—

Firstly, there is a lack of facilities in the field. In the study of mineral shortage (to take one example only) it is absolutely essential for the Nutrition Section to carry out feeding tests in selected localities. Such tests could be conducted very easily on farms belonging to the Provinces. The Nutrition Section has carried out one test of this kind at a cost of Rs. 300, the funds being obtained from a special grant. The experiment was carried through without a single hitch and now the Section has received two cordial invitations from Provinces for further experiments of this kind. Unfortunately we cannot undertake this work because it involves the expenditure of money from Central revenues at a provincial farm and the temporary transfer of one or two subordinates from headquarters to a provincial farm. As matters stand at present this constitutes an improper diversion of Central revenues, though actually it is a very economical arrangement. Instead of opening up independent cattle farms the Nutrition Section could co-operate with the Provinces, using their cattle and their foodstuffs free of charge, for the elucidation of nutrition problems which are of vital interest to the whole country. Considering the tremendous economies which this proposal offers, the unnecessary duplication of farms which it avoids and the possibilities it opens up for real progress in Nutrition questions I feel confident that the Government of India will be prepared to sanction work on these lines at once, if it is approved by the Royal Commission. Animal Nutrition in India cannot be studied adequately if the work is confined to a laboratory at headquarters.

In addition to field work in the Provinces some field work is essential at headquarters. The Dairy at Bangalore as at present constituted has no land whatever to spare. In fact there is no room here for two Sections. Either it must be a Dairy Institute or it must be a Nutrition Institute. The space is even cramped for a Dairy Institute alone. The fact that the Dairy purchases a large proportion of its roughage from outside is a sufficiently striking proof of this statement. The place is not ideal for a Nutrition Institute especially as it is under an obligation to provide milk for the troops, but the milk production could be reduced down to the Military requirements and thus the available space of nutrition work would be considerably increased.

Further, important nutrition work on milk production must be undertaken in this country. Much of this work will have to be done in collaboration with other dairies but some of it must be done in a dairy attached to and in the control of the Nutrition Section. The Nutrition Section requires a dairy and the Bangalore dairy suitably modified would meet the requirements. I must make it quite clear here that it is not my wish to obtain this place for the Nutrition Section if the Dairy Section finds it suitable and wishes to retain it. The point is that there is not room for the two Sections here. We are blocking one another on the ground. In other respects too the close juxtaposition is not healthy. The Dairy Section gives a dairy diploma course and relies upon the Nutrition Section for lectures on elementary science,

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nutrition and dairy chemistry. Needless to say the Nutrition Section gives what it can gladly. We are pleased and we will always be pleased to be able to do anything we can in return for the whole-hearted help we have invariably received from the Dairy Expert. But the fact nevertheless remains that the Dairy Section is incompletely staffed and has to fall back on this Section. The conditions do not make for healthy development.

Another great difficulty to which I have referred in my memorandum is due to the fact that the dairy is run as a commercial concern and is therefore obliged to go in for cross-breeding. The result of this cross-breeding is that there are very few calves available for experimental purposes. The Nutrition Section was transferred to Bangalore because it was believed that we would have an ample supply of animals here. In the case of calves this is not so. There is an ample supply of cows and the Section will very soon be able to commence new work on milk production, but it is not likely that we can do a great deal even on milk production until we have a dairy under our complete control. In this connection it may be recollected that the School of Animal Nutrition at Cambridge recently decided to establish a dairy of its own for carrying out investigations in milk production.

The situation of the Bangalore dairy so far from residential quarters is another great drawback to the work on Animal Nutrition. For efficient work quarters are required here for the entire staff.

In conclusion, I consider that the site would probably be suitable for either of the Sections, but it is not suitable for both together. If it is intended to establish efficient and well equipped Sections for Dairying and Animal Nutrition more space is absolutely essential to allow for the necessary expansion. I would like to suggest the Belgaum dairy as a suitable place. The Military authorities might be prepared to hand it over on terms similar to those under which the Bangalore dairy was transferred.

QUESTION 16.—FODDER AND ITS STORAGE.—*Sorghum* is the most important fodder in India. Broadly speaking there are three types:—

1. Grain *Sorghum* used only for human food. The stems are very thick and cannot be fed to cattle. They are frequently used as fuel.
2. Grain and fodder *Sorghum*. The grain is used as human food. The stover (dry stalks and leaves) is chopped and fed to cattle.
3. Fodder *Sorghum*. This type is grown only for cattle food and is fed green.

We have carried out a few tests with a stover (chopped stalks and leaves) of the second type. Considering the nature of the fodder it is eaten with fair relish and the digestibility is as good as or better than rice straw. For older animals which can eat it in sufficient bulk it is superior to rice straw. The dry fodder is easily preserved in stacks. Tests, carried out by the Nutrition Section, with green *Sorghum* have shown that it is a rich, nutritious and easily digested food. An experiment at Bangalore with very carefully cured *Sorghum* hay, probably the best that has ever been made in India, was not very encouraging. The digestibility was not high. It would appear therefore that hay-making from *Sorghum* is not likely to help agriculture. *Sorghum* silage on the other hand is remarkably good. It has been repeatedly tested at Bangalore and has given excellent results. Silaging fodder *Sorghum* for storage can therefore be recommended strongly. Hay-making does not seem to be satisfactory. However very much more information is required concerning the merits of *Sorghum* stover and hay.

Hay.—At Bangalore we have tested numerous samples of hay from different parts of the country baled, stacked and fresh samples have been examined. Generally the quality has been poor, many samples being less nutritious than rice straw. The causes of this bad quality have not been worked out yet. In some cases it would appear that the soil and climate were at fault. The green plant itself was poor material, containing a very high percentage of silica. The proportion of silica however is not always an index of quality. Rice straw is rich in silica but is moderately digestible nevertheless. In some

cases the bad quality was undoubtedly due to late harvesting. Experiments on the question of harvesting are very urgently needed. It is quite possible that in some localities the grass is over-ripe at the time of the rains. It is useless to attempt hay-making in such regions. A better use of the food would be to convert it into silage for local consumption. It is important to find out whether there are areas where good hay can be made.

Preservation of green fodders.—I believe that silage making as an art unknown to indigenous agriculture, can be introduced almost everywhere for preservation of grass and monsoon fodders. Fodder preserved in this form is very easily digested whilst drying fodders in this country seems to lead to reduced digestibility in some cases. I believe Indian agriculture will benefit very materially by the extensive use of silage.

NUTRITION IN RELATION TO BREEDING AND MILK PRODUCTION.—1. More stress should be laid on the fact that provision of good bulls is not sufficient to improve the cattle. Deterioration must be attributed partly to bad feeding. The food-supply should be studied in areas where bulls are introduced.

2. There are some difficulties connected with the feeding of good dairy cattle in India. The ordinary milk mixtures which have been found satisfactory in Europe are too expensive to be used here. It is important to carry out tests with a variety of our economical mixtures over very long periods to determine what effect they have on the cow's life and vitality. Will her useful life be affected materially by such differences in feeding? This question is of very great economical significance. It can only be studied by well organised co-operative tests. The question of mineral supplements for cows is another matter on which the milk yield, the cow's useful life and the vigour of her offspring depend. There are many vague beliefs regarding stimulating foods and foods which tend to hasten drying. Dairy men require assurance on these points. For the dairy industry therefore special nutrition enquiries are needed. In this work the guidance and co-operation of a strong Nutrition Institute are indispensable.

3. *Breeding and milk production in cultivated areas.*—I believe silage would greatly benefit breeding and milk production in cultivated areas. Under normal Indian conditions it is the young calf that suffers most of all. It is put on to hard dry roughage long before it has developed a capacity for such food. In Bangalore the Nutrition Section has observed the fatal effects of feeding average quality Indian hay to calves. They cannot learn to fill themselves and the Net Energy Value of the food consumed is barely sufficient for maintenance. It is useless to add a rich oil-cake to such a ration. On the other hand silage feeding to young calves has given us remarkably good results. It has never failed. Legume hay is also worth considering. I made hay from *Phaseolus Mungo* in Burma. It was a rich food and was very much relished by cows and young stock. I believe that some legumes containing prussic acid could be converted into perfectly safe and nutritious hay. For example, *Phaseolus Lenatus* plants contain a very large amount of prussic acid but on drying in sunshine the poison is completely eliminated. Such legume hays would form excellent food for growing cattle.

PASTURE PROBLEMS.—The pasture problem in India is intensely complicated and our knowledge of the different aspects is meagre.

1. *Quality of pasture grasses.*—We distinguish good grasses from poor ones partly by the conditions under which they thrive, that is to say, we assume that the good grasses are those which grow on good ground, but we have no direct evidence that the so-called poorer grasses are not equally nutritious when they occur on good ground. The Nutrition Section working in collaboration with the Bombay Department of Agriculture is attempting to clear up some of these preliminary difficulties. We may also distinguish poor and good grasses from the way they are relished by cattle. Here again it is not likely that the nutritive value is the only factor influencing relish. Taste, smell and presence or absence of hard awns play a part. That cattle are greatly influenced by taste was demonstrated a short time ago in one of our

Bangalore experiments, in which some of the animals refused to touch a very nutritious soft hay which is eaten with relish by animals brought up on it. The same thing doubtless occurs on pasture land. The animals are eating one kind of grass and it is practically impossible for them to change over to another kind of perfectly good grass even if they are nearly starving. It is by no means impossible that at some future date the question of taste and smell will have to be studied chemically to elucidate our feeding difficulties. The awned grasses such as *Andropogon contortus* are definitely a great nuisance in our pastures and must be classed as bad though the cattle do eat them sometimes. The Nutrition Section is engaged at present in determining the intrinsic values of different pure species and in estimating the effect of environment on these values. The mineral question is receiving attention at the same time. As this work has only just commenced there are no data available.

2. *Improvement of grazing areas.*—Grazing is a process of selection in which the animal consumes the good grasses and leaves the poor grasses. It might be supposed therefore that light grazing would tend to eliminate the good species and favour the poor ones. Carrying the same argument further, close grazing should be less harmful because it would cause a reduction of the poor grasses also and hence less change of herbage should result. Another method of avoiding selective consumption is to mow the grass. In this way all species have an equal chance and the pasture should accordingly improve. These expectations are entirely contradicted by practical experience, which shows that close grazing is generally fatal to pasture land in India, whilst mowing does not bring about any improvement in species. The herbage depends mainly upon the quality of the soil and upon its moisture content. Close grazing reduces the organic matter in the soil (the root system is reduced to begin with) and also the water holding capacity of the soil and the soil moisture, whilst erosion is favoured. The soil becomes poor, the yield of herbage falls and its quality declines. Dr. Burns in Bombay has shown that fencing and protection from overgrazing improve the soil and the herbage. Bunding and regulation of the flow of water may be expected to produce good results also. Cultivation, which has recently yielded such good results in Great Britain, might be tried with advantage, but in making such attempts in India certain precaution would have to be observed. The first effect of cultivation is very often a great stimulation of weeds and a set-back for the grass. Light disc harrowing is most likely to help the grass. I have no practical experience in this matter however. Much better cattle food may be expected from areas of mixed farming, but the close grazed areas are too poor to be cultivated. There are innumerable instances in this country of crop production on the fringe of culturable land. The grass is ploughed up and a meagre crop of *juar* is obtained. Following that we have a useless plot of weeds for a couple of years after which the grass slowly establishes itself again. It seems to me that amelioration of the land might be tried in such areas, by fencing, encouraging grass growth in accordance with Dr. Burns' procedure and control of surface water.

3. *Mineral deficiencies in fodders.*—The Nutrition Section is collecting material from various sources for the study of this important question. The bulk of the work at present consists of chemical analyses of typical samples. One very remarkable result has been obtained in a feeding experiment. A sample of Indian hay supplemented with concentrate gave a negative digestion of minerals. When it is recollected that only a part of the digested mineral matter is retained in the body it becomes clear that we are here in touch with a most serious case of mineral shortage. It is probable that the question of mineral deficiencies is one of the most important nutrition subjects in India.

Oral Evidence.

A.414. *The Chairman* : Mr. Warth, you are Physiological Chemist in charge of the Animal Nutrition Section in Bangalore?—Yes.

A.415. You have put in a very interesting note for which we are greatly obliged. I have very few questions to ask you. Your note is concerned mainly with technical points. I have no doubt that we shall learn a good deal from our visit to your Institute this afternoon?—I hope to show it to you this afternoon.

A.416. I see that in the early part of your note you point out that there is difficulty at the moment in your making the fullest use of your opportunities for collaboration with the provincial authorities owing to the decision of the Government of India that Central revenues ought not to be spent on provincial institutions?—I would not like to put it quite so definitely as that. I do not know that there has actually been a decision on that point; it has been pointed out to me by the Agricultural Adviser that this would probably not conform with the conditions at present prevailing.

A.417. Has any expenditure suggested by you ever been turned down on that ground?—I wish to do an experiment immediately, and it is being held up on that account.

A.418. So that it would seem in that case that a definite ruling of the kind I have mentioned has been given?—Yes.

A.419. Do you find the Provinces anxious to make use of the help which you are giving them?—I have been cordially invited in two places.

A.420. And you think, to get the best value out of the money expended, that the Government of India would be well advised to allow the Central revenues, under proper safeguards, to be spent in the manner you suggest?—I do, because I consider the work cannot be done unless it is done in those particular places which we select.

A.421. On page 66 an interesting point is raised. You are talking about the difficulty of carrying on research work in a dairy run as a commercial concern. Is it your view that herds or dairies run for the purpose of research are not to be expected to pay their way?—If they are doing research work they cannot pay their way.

A.422. When you come to demonstration, that is a different matter altogether, is it not?—If you are to demonstrate the profitableness of a procedure it must be profitable.

A.423. And it is very important not to attempt to demonstrate on the profit-earning potentialities of an industry at an institute where money is spent on research unless you have your experiments entirely separated?—It would be very difficult to separate them; it might possibly be done.

A.424. Have you had personal experience of propaganda?—I have had no experience of that kind at all.

A.425. I judge from your paper that although you have done a great deal of work already you yourself feel that you are only at the beginning of your labours?—We have only commenced; we have just begun to touch the problem.

A.426. And yet the results which you set down here appear to a layman like myself to indicate great possibilities for the future?—The conditions are so absolutely different in India that we are bound to point out important facts.

A.427. You are really doing entirely original work?—Because the conditions are so different, the work is quite original.

A.428. You are doing some important work in the matter of the nutritional value of various fodders?—Yes.

A.429. How do you envisage that information being placed at the disposal of the cultivator in his village when it is ready for publication?—I envisage

all this information as going to the cultivator through the experts who are dealing with cattle, not from me to the cultivator.

A.430. It will be a question of recommending particular fodders?—To the institutions where work on cattle-breeding, cattle-feeding and dairying are proceeding.

A.431. We are accustomed in Great Britain to be advised by experts like yourself as to the proper balanced rations. That is hardly a practical proposition in this country, is it?—With regard to the feeding of cows it is an important matter, especially when they are high milkers; that will be a difficult matter in this country as I have pointed out in my answers.

A.432. But you do think that your work will lead to interesting results in the matter of choice of foodstuffs for cattle. Do you think it likely that your results will suggest that particular cattle are more suitable to particular districts owing to their capacity to digest and make the best use of food produced in those districts?—I cannot say; it is possible.

A.433. You are very emphatic as to the value of silage and as to the practicability of successful propaganda in the direction of spreading the practice of making silage?—Because our results have been so very satisfactory with it; they have been altogether satisfactory; it is easy and cheap and good and sure. It cannot be burnt of course.

A.434. Is it spreading at all to your knowledge?—I believe all the Provincial Governments are doing their best to push it forward.

A.435. Of course to the uninitiated mind it looks so improbable as a process until you see it done that it is difficult for them to believe that it is practical?—Yes, it is so.

A.436. I take it the only hope of persuading the cultivator to adopt it is to give him a demonstration under the conditions with which he is familiar?—Yes, and the demonstration is so easy.

A.437. On page 64, you give the Commission your views as to the merits of Dr. Clouston's proposals for the co-ordination of research work in general in India. Have you any ideas of your own other than those which you have set down in your note of evidence as to the constitution of a central body which might be set up?—I have not gone into the details at all. My object in writing this was to give an example of how extremely useful such a scheme would be as applied to the work of animal nutrition and suggesting that in all probability it would be equally useful in other directions.

A.438. I see that like Mr. Smith you are of opinion that sooner or later a separate herd at a separate institution will be required for your work alone, apart from the dairying and cattle-improvement work?—The point is that the place we have will not contain us both; we are at the limit; we are in fact stepping on each other as it is.

A.439. Would you rather go to a distance with an entirely new institution or would you rather have an extension here?—I am afraid the question of extension here would be found to be impossible. There is simply no land available, and therefore it cannot be considered. I am afraid that is the case.

A.440. It does seem at first sight that contiguity as between the work being carried on by Mr. Smith and the work immediately under yourself would be an advantage in the matter of teaching?—It is a most unfortunate thing; I regret it; but the place will not admit of it.

A.441. You and your staff are doing a certain amount of teaching?—We are doing what we can; I do not think that the teaching that we are doing for Mr. Smith's section is of such a high standard that it could not be done very easily by his own people if he had more staff. That I consider a trifling matter. There are other matters where contiguity would be useful in combined efforts; that is mainly what we would be losing.

A.442. Do you not think that in the future the teaching side of your work will necessarily increase?—I consider that the main increase I may expect is in the matter of post-graduate students, not in direct teaching of junior students.

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A.443. So I should expect; so that having that in mind, you see no reason why post-graduate training in your work should not be carried on at a separate institute?—Quite easily.

A.444. Are there any signs that greater interest is being taken in teaching animal physiology?—I cannot say.

A.445. Are you having any applications at all from graduates?—We train about a man or two a year, mainly men who are going in for dairying. We have at present a man under training, a qualified man in other ways, who is going to take up the work of animal nutrition in the Madras Presidency.

A.446. Are there other openings in India for the type of physiological chemist whom you would train as a post-graduate learner?—At present, none. I think the work of animal nutrition must increase throughout the country, and if that were so, we would probably have the duty of training men for the posts.

A.447. Do you think that the teaching side has an important reaction on the research side in the case of your own work?—It is no drawback whatever; it is probably a help and an inspiration.

A.448. I do not know whether there are any other observations of a general nature that you would care to make before I ask my colleagues to put questions to you?—I have nothing to say.

A.449. *Sir Ganga Ram*: Have you published any pamphlet naming the different fodders on which you have made experiments, and the results?—We are slowly publishing the work that we are producing, but we have not got very far with the work of publication at present.

A.450. I only want to know the names of the different fodders on which you have made experiments?—We have recently done a large number of experiments on samples of hay produced in this country.

A.451. What do you mean by hay?—I mean grass duly cured to make it into hay.

A.452. Not wheat straw?—No. We are about to test wheat straw; we are about to carry on a long experiment on wheat straw.

A.453. And gram straw?—We have not done that.

A.454. Have you made any experiments on *senji*?—No.

A.455. Do you know what *senji* is?—I do not.

A.456. Mr. Smith probably knows about it. In the Punjab it is largely given to milch cattle; we call it *senji*?—We would like to test it. There is a tremendous task before us of testing innumerable foodstuffs; we know nothing about them at present.

A.457. What is the meaning of “roughage”?—All foodstuffs which are bulky and not highly nutritious.

A.458. It is not a mixture of straw and cake and that sort of thing, is it?—Well, the cake is a concentrate, but straw is the roughage.

A.459. You say there is a mineral shortage. Do you mean salt? Or what?—Recent work in England has shown that many foodstuffs are short of lime, phosphoric acid, and minerals of that kind. We believe there are severe shortages of these essential minerals in various parts of the country.

A.460. Lime, phosphoric acid and what else?—I am afraid I said “and various other minerals.” It may be sodium and chlorine.

A.461. And salt?—Yes, and salt.

A.462. *Sir Thomas Middleton*: You have just told us that your main work at present is investigating the quality of food materials?—Yes.

A.463. You have got, I assume, a pretty good knowledge of the composition of the grain of India?—I had to select what work seemed most essential and it appeared that we know more about the grain crops than about the coarse foods, so that I have specialised in coarse foods.

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A.464. There have been a large number of analyses of the main food grains of India, but the coarse fodders have never been investigated?—That is so.

A.465. How are you dealing with the problem of the quality of the coarse fodders? First of all is there a chemical analysis?—We carry out chemical analysis in these, combined with digestion experiments and long or short period feeding tests, in fact as big a test as we can with the material available.

A.466. You do carry out digestion experiments here?—Yes; we do not consider we have carried out anything at all unless we have carried out digestion experiments.

A.467. Supposing you take one material such as *Sorghum* fodder grown and harvested under various conditions in India, do you find very wide difference in the digestibility of the samples of *Sorghum*?—That is an important piece of work which remains to be done; we know nothing about that.

A.468. You are at present concerned with the types and not the variations?—Yes.

A.469. Could you give an indication of how many types of grasses you have had under investigation? You have investigated mixed herbage, but I suppose you have also been dealing with individual species?—For feeding tests we have not carried out a single test for absolutely pure herbage yet except perhaps *dhub* grass. That was probably almost pure. We have also tested Rhodes grass.

A.470. Have you tested guinea grass?—Guinea grass we have not actually tested, though it is on the farm. The other fodders were mixed herbage as found in various areas.

A.471. *Sir Ganga Ram*: Have you published any pamphlets on these two grasses?—I have not.

A.472. Where can we get them?—We are not quite ready to publish these things yet; we are collecting the information.

A.473. *Sir Thomas Middleton*: So that you are not able to verify the Indian cultivator's opinion of his several species; you judge from an examination of the mixed species in hay, and can only form a rough idea of the relative quality of the grass contained in the hay?—That is so. But the work is only beginning; that is really the point. I cannot speak with certainty about any of those matters.

A.474. Now, coming from the food materials to the needs of the animal, are you doing any independent work to ascertain the needs of the Indian animal as distinguished from the needs of those that have been worked out in other countries; e.g., do you adopt the usual standards provided for the milch cow in Europe and America as a basis for the standards in use in Bangalore or have you investigated the needs of the Indian cow independently?—We have studied the effect of feeding cows in India with the standards adopted in America; we have to use American standards because they apply more to our foodstuffs than the European standards. We have found the cows very economical in the use of this particular standard. I cannot say more than that at present.

A.475. *Professor Gāngulē*: The Armsby standard?—The Armsby and the Henry and Morris, or both.

A.476. *Sir Thomas Middleton*: You have been using American standards. Are you using the bomb calorimeter in your work?—We have done no calorimetric work. I admit it is an urgency; but we have got to build up these things.

A.477. Whereas the standards required for milk production have been pretty fully worked out in other countries, we are still very ignorant of the animal's needs for work production; especially as such standards as exist have been worked out for the horse. Has any attention been given in India to the needs of the working bullock as distinguished from the milking cow?—Actually

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some work has been done; but we have not got good figures at present. I see no way of attempting that problem immediately.

A.478. It is a very difficult problem?—But we have considered it, and we have got plans partly prepared for doing work.

A.479. Would you say in the case of the working animal as in the case of the milking animal, that the Indian animal is economical in its needs?—I have found the Indian bullock extremely efficient in digestion; I can say nothing more than that.

A.480. The Government of India supplied a memorandum to the Civil Research Committee last year on the question of mineral deficiency in pasture. Did you take part in the preparation of that memorandum?—No; I had no information to give. But we have since then made a little progress, but there is very little progress to record.

A.481. That explains your answer to Sir Ganga Ram?—Yes.

A.482. Could you be more specific; could you indicate to me any districts in which there are indications of mineral deficiency?—I suspect one district, but I would rather not say anything definite at present.

A.483. Have any cases of iodine deficiency come to your notice?—No.

A.484. You make a suggestion in your memorandum about the possibility of adopting a method that has given good results in Great Britain recently in improving our poor grass land. Are you referring to Professor Stapledon's writings?—Well, actually when I wrote that I was thinking of some of the work they have done in Wales.

A.485. That is Professor Stapledon's work?—Yes.

A.486. You must recognise that Wales has a climate which is peculiarly suitable for this method of improving pasture land. I personally should doubt very much whether it would be likely to succeed under Indian conditions?—I am not prepared to say anything on the subject except as a suggestion.

A.487. *Dr. Hyder*: There is some post-graduate teaching done here under your direction?—I have had students during the last three years.

A.488. And you are not satisfied with the standard of knowledge of chemistry with which these people are equipped?—It depends on what work they are to do when they leave me; if they are to be cattle-breeders or cattle experts, I consider that I have shown them something about the value of food-stuffs which will be useful to them; if they are supposed to go back to their Province and take up the study of animal nutrition, I say they cannot do it.

A.489. Let me go into the question of the relation of Indian Universities to the instruction given by you. You know that we have the B.Sc. and the M.Sc. In the B.Sc. you must have either chemistry or physics and one more subject. In the M.Sc. you need have only one subject, chemistry for example. In the Honours course there is a thorough grounding in chemistry, and one or two subsidiary subjects, *i.e.*, to test the knowledge of the student in English and in another subject like that. I cannot make discrimination between the Universities, but take the M.Sc. or the Honours standard. Do you think a man who takes an Indian M.Sc. degree in chemistry would be able to carry on such researches as you are carrying on after he has passed through a course of training given by you?—I see absolutely no reason why he should not; there is no reason at all. I should say that he has undergone a training which will fit him for the work. It depends upon the man entirely; I think he would be perfectly able to do it; there is no reason why he should not be able to do it under those conditions.

A.490. For the proper development of post-graduate teaching here so that these people might become dairy experts or might carry on research such as you are carrying on, would you insist upon either an Honours degree in chemistry or an M.Sc. degree?—It depends upon his future work. If he is to do this class of work then he must have a high training in chemistry or the allied work that he proposed to take up; if he is going to be more on the agricultural side, that is not necessary.

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A.491. That, of course, would be a waste, if he went to the agricultural side and gave up the special training which he has received?—If he is going to be a cattle expert, he really ought to be a cattle expert even when he comes to me; an Honours degree in chemistry is not required for that part of the work; but if he is going to take up the study of nutrition, then he must possess chemical knowledge.

A.492. Our object is to aim at the production of bio-chemists attached to different institutes in different Provinces of India. I personally consider that it would be a waste of your time and resources if these people went over and became cattle experts?—I should say that they would have had one kind of education and were going to try to do something else.

A.493. There are no other bio-chemists attached either to the Indian Universities or attached to departments of Provincial Governments?—There is nutrition work being carried out; very useful nutrition work is being carried out at Lyallpur by the Agricultural Chemist there.

A.494. *Sir James MacKenna*: What do you consider to be the most important All-India problem in animal nutrition which is facing us at present?—I think the mineral deficiency in our foodstuffs is the most important All-India problem.

A.495. Have you taken it up yet?—We tried to take it up.

A.496. What are the difficulties in getting on with that?—It is again this question that we have just had before us; I cannot do the test at the place where it is essential that the test should be done.

A.497. That brings you up against the Devolution Rules?—Yes, the Devolution Rules are hindering this work which, I must say, is the most important question.

A.498. Until you have free access to the Provinces and the right to spend money in the Provinces, you cannot get on with this very important All-India question?—No, I cannot.

A.499. You are doing a certain amount of work on fodder crops?—Yes.

A.500. Have you any facilities here for testing fodder crops?—There is no room at the dairy, as I have already pointed out, and it is absolutely essential that I should grow crops for testing. I cannot grow any crops for testing.

A.501. Can you give us any rough idea of the equipment and the staff necessary to make your section self-contained and adequate to tackle the problems you have in front of you?—Well, just to deal with this one single point I consider I require 100 acres of land for fodder crops.

A.502. What staff do you require?—The farm staff to deal with that.

A.503. That is a matter of detail?—Yes, I have not considered it.

A.504. That is a matter for you to fight out with the Government of India?—Yes.

A.505. *Professor Gangulee*: For the investigation of mineral deficiency, you could not get adequate laboratory facilities?—Our laboratory is very small, as you will see this afternoon. We can do a fair amount of work in it; we are not really afraid of that; but the chemical analysis of foodstuffs does not give the necessary information. You must test it on the animal and you must test it on the animal at the place where it is produced. That is our trouble.

A.506. And for that you have not got sufficient funds?—It is not so much the funds; it is the procedure which is illegitimate almost, you may say, for us to follow at present. We have not the right to work at the places where we want to carry out this work.

A.507. Your expenses are another question; the question is that you have not the proper facilities for carrying on the work?—Expense is a small thing, but of course it is a factor which prevents us from working; we are not allowed to expend the money for that object in the Province.

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A.508. You say in your memorandum that you took up this duty of training these post-graduate students voluntarily; was that without any direction from the Central Government?—If you wish me to lay stress on that, I more or less insisted on doing it, when it was perhaps objected to.

A.509. You felt the necessity of having post-graduate students?—I wished to have them.

A.510. And without any direction from the Central Government?—Not in the first place, no; I asked for it, and then I was allowed.

A.511. About 7 students have already completed the course?—Yes, about 7.

A.512. Could you tell us how they are being employed now?—One of the students is Assistant Professor of Agriculture in the Punjab; two, I believe, are Deputy Directors in the Punjab; one is the Manager of the dairy at Nagpur.

A.513. It is rather gratifying to see that you hold a very high opinion of those who actually took the course?—They were selected men who were sent to me, and I found them very nice and agreeable men.

A. 514. And yet you say definitely that these men were not fit for higher posts?—I said they were not trained for taking up the work of animal nutrition. I think I gave you that reply.

A.515. *Dr. Hyder* : May I make that clear? If you had a first class or second class M.Sc. of an Indian University and he received training under you, would you say that such a man was fit or not fit for a first class post?—I say that there is no reason whatever to suppose that he would not be fit.

A.516. *Professor Gangulee* : What are the qualifications of these men that you have trained?—I specified them in my memorandum. I cannot say exactly now what it was. They had not specialised in the important and necessary subject.

A.517. Referring to your own research, you have made a very good beginning in the investigation of some of these fundamental problems of animal nutrition. Have your investigations attracted the attention of the Provincial Departments of Agriculture?—I do not think the Provincial Departments of Agriculture are really at present aware of what work has been done. We have not been able to publish very much so far.

A.518. You say, I think, in your printed memorandum that the Military dairy farms took up the question, and they came to you for advice and direction, and also that you started co-operative experiments in the Provinces of Madras, Bombay and so on?—That is so.

A.519. They were attracted by your work?—Perhaps we went to them; they did not come to us. We cannot say that the work has made any great impression on the country, because it has just commenced.

A.520. You do a considerable amount of advisory work, I see here, for the provincial departments?—We answer questions occasionally. I consider we have not done very much in that direction.

A.521. Do these Provincial Livestock Experts pay occasional visits to Bangalore in order to study these various lines of investigation?—No, they do not.

A.522. The most important experiment to my mind is your digestion experiment, and you have obtained the co-efficients which enable you to estimate the digestibility of cattle fodder and cattle foods. Now, are you undertaking a study of the relative values of Indian fodder and feeding stuffs?—At present, we are studying the relative value of all fodders by co-ordinated long-period feeding tests, and seeing how much fodder is practically required to maintain animals. That is the way we are comparing them at present; it is not a very accurate method; when we have more means, we will institute more accurate procedures.

A.523. But, nevertheless, this work is so important that the Provincial Livestock Experts ought to be interested; do you mean to say that they are not interested?—Again, I say we have worked here for 2½ years only. Before

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a year and a half was over, we could not publish anything; we have now commenced to publish. People are perhaps beginning to know that we exist, and we hope to have a great deal of contact with these people later on.

A.524. You have published articles in the *Agricultural Journal of India* which I read with great interest?—I have published two articles in the *Journal* and two memoirs so far; it is merely a fraction of what we have to do.

A.525. You mention here that feeding tests may be carried out in any part of the country. Do you receive any requests from the Provincial Agricultural Departments for the purposes of such tests?—Fortunately, we have the Imperial Dairy Expert's farm at Karnal, which is always open to me, as everything of his is generously open for work; and we have carried out experiments there many miles from our headquarters; we have actually commenced another experiment this year.

A.526. So that, in view of this, shall I say, apathy of the Provincial Governments, you feel that co-ordination of some sort is necessary?—I do not wish to say that the Provincial Governments or the Provincial Departments are apathetic in the least. I do say that co-ordination is very important. I have pointed out the ways in which co-ordination will help the work, and I think of course the means must be provided for carrying out this co-ordinated work.

A.527. Do you think that the existing organisation is inefficient to bring about that co-ordination which you desire?—From my note, you will see that I consider it is inadequate, and I consider that the provision of these facilities for co-ordination will yield very good results as far as the nutrition of animals is concerned, and I believe they would act beneficially in other branches of research also.

A.528. Would you like to have an Advisory Council, functioning on the same lines as the Council does in England?—Yes; it would be advisory, with the proviso that there are acting committees under it.

A.529. No executive authority would be given to this Council?—It is hardly for me to make recommendations of that kind. If we give executive power, it would be all the better.

A.530. I raise this point because you say here "would arrange for the execution of co-ordinated work." That suggests that you are looking for executive authority vested in this Council. Do you think the Board of Agriculture is functioning in that direction as an Advisory Council?—Yes, for the purposes which we are thinking of; in co-ordinating work we want something stronger, and provided with funds and power for carrying out co-ordinated work.

A.531. Then you will not be satisfied merely with an advisory function?—I think it must be mainly advisory.

A.532. With regard to your *Sorghum* silage, what type of silage have you evolved? Have you evolved any particular form?—No particular form; I have just tested the ordinary *Sorghum* silage here.

A.533. Would your method be expensive for the farmers?—The cutting is an expensive item.

A.534. *Dr. Hyder*: I was wondering whether you, as Physiological Chemist, were also considering the question of the best method of preservation of the vitamin contents of such fodder, so that the vitamin contents of the milk and other produce may be preserved and increased?—There are many important questions which we would like to tackle, but cannot do so.

A.535. *Mr. Kamat*: On page 59 of your memorandum you say that the cross-breeding principles on which milk production at Bangalore is based are an endless trouble to the Nutrition Section. You also say there that the dairy only wants to have half-bred cows, and that their offspring is a useless mongrel, which they must sell. Do I take it that you disagree with this principle which the Bangalore dairy is following?—Not at all. The only thing is that it does not help me in getting the cattle I require for experimental purposes. They do not keep their calves because they are not very valuable to them, and we have not got as many animals as we would like for experimental

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purposes. I have no criticism whatever to make with regard to the principle of cross-breeding.

A.536. So that, the complaint is only from the point of view of the experimental work?—That is all.

A.537. Not from the point of view of breeding or milk production?—Certainly not; I could not possibly criticise it.

A.538. And then the remedy you suggest at the end of that paragraph is to put the dairy on an experimental basis, which would enable it to breed and select animals. Will you please explain what that means?—If the dairy were breeding country stock, they would not mind keeping all the young animals, and I would thus have more young stock to work with.

A.539. You agree that this policy of selling the offspring from the cross-bred cows is the right one, which even private cultivators can follow?—I have nothing to do with that subject whatever.

A.540. You do not wish to express an opinion on it?—It does not concern me; I would rather not.

A.541. *Sir Ganga Ram* : What propaganda do you employ now to teach the agriculturists the value of your labours?—In answer to the Chairman I explained that I propose that all the results we obtain should be made known through the Agricultural Departments and not from me direct.

A.542. It has not been done so far in any shape or form?—No; I would rather not do that; I am not in contact with the agriculturist. I am doing experimental work, and I would make it known to the Agricultural Departments.

A.543. Are your reports secret?—Certainly not.

A.544. Is there any publication of these reports?—There is the annual report to be had, and there are other publications that we make, in the form of bulletins, or memoirs, or any articles in the agricultural journals.

A.545. Is yours the only Institute of Animal Nutrition in India, or are there any others?—There is an institute in the Punjab, which I mentioned, where work on animal nutrition is being done to a small extent.

A.546. Is that a subject of the College?—It is one of the experimental subjects.

A.547. Who is doing that?—Dr. Lander, Agricultural Chemist to the Government of the Punjab.

A.548. *The Chairman* : You would agree with me that the scientist who rushes into print before his results are ready for publication is rather apt to find that his reputation goes up like the rocket and comes down like the stick?—I agree with you.

(The witness withdrew.)

The Commission then adjourned till 4 p.m. on Thursday, the 11th November, 1926, when Mr. N. Rama Rao, Sericulture Expert with the Government of Mysore, was examined. It then proceeded to take evidence at Coimbatore from 13th to 16th November, 1926. For the evidence of Mr. N. Rama Rao and the first 6 witnesses (provincial) at Coimbatore see Volume III. The last witness to be examined at Coimbatore was Rao Sahib T. S. Venkataraman (Imperial) whose evidence follows.

Tuesday, November 16th, 1926.

COIMBATORE.

PRESENT :

The MARQUESS OF LINLITHGOW, D.L. (*Chairman*).

Sir HENRY STAVELEY LAWRENCE,
K.C.S.I., I.C.S.
Sir THOMAS MIDDLETON, K.B.E.,
C.B.
Rai Bahadur Sir GANGA RAM, Kt.,
C.I.E., M.V.O.
Sir JAMES MACKENNA, Kt., C.I.E.,
I.C.S.

Mr. H. CALVERT, C.I.E., I.C.S.
Raja Sri KRISHNA CHANDRA GAJAPATE
NARAYANA DEO of Parlakimedi.
Professor N. GANGULEE.
Dr. L. K. HYDER.
Mr. B. S. KAMAT.

Dewan Bahadur T. RAGHAVAYYA PANTULU }
GARU. } (*Co-opted Members.*)
Rao Bahadur B. MUNISWAMI NAYUDU }
GARU.

Mr. J. A. MADAN, I.C.S. }
Mr. F. W. H. SMITH. } (*Joint Secretaries.*)

**Rao Sahib T. S. VENKATRAMAN, B.A., I.A.S., Government
Sugarcane Expert, Coimbatore.**

Replies to the Questionnaire.

QUESTION 1 (b).—One obstacle to the realisation of the maximum benefit from the sugarcane breeding work at Coimbatore is the non-availability of sub-stations in the main sugarcane provinces of the country under the direct control of the Coimbatore station.

The Coimbatore station is intended to produce, by breeding, improved types of seedling canes for every part of India. There are three essential requisites for the proper discharge of this function by the station : first, the actual production of the improved cane seedlings; second, the careful testing of the improved types with the indigenous kinds with a view to selection; and third, the distribution of the new canes to the cultivators.

Over 80 per cent of the Indian area under sugarcane is in sub-tropical India, where the canes do not generally flower, or even if they do, do not set seed. The breeding of canes for the whole of this region has, at present, to be done at Coimbatore in South India. The station at Coimbatore is now in a position to raise any number of seedlings and with most of the desired parentages. It may now, therefore, be assumed that there are no very serious difficulties as regards the first requisite.

The second requisite, *viz.*, the testing of the new canes in comparison with the local kinds and their selection, is at present done in two stages. The leading indigenous canes of Northern India are now acclimatised at Coimbatore and the new productions are compared with the indigenous kinds at Coimbatore itself and a preliminary selection made, of such as are distinctly superior to the indigenous varieties. This first selection at Coimbatore is made none too rigid, through fear of losing any that might ultimately prove useful, when actually grown in Northern India.

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The second, and by far the more important selection, has to be made in the locality itself and this is, at present, done in the Provincial Government firms. Experience shows that these testing stations could be divided into at least three different groups according to the manner in which the selection work is carried on.

We have, first, the class of stations which have an intimate knowledge of local conditions, know exactly which sort of cane will be an improvement on the canes in the locality,—are keen about the trial and spread of the new canes in the locality and are, therefore, only too eager to take full advantage of the Coimbatore work. Such stations render all possible help to Coimbatore in gathering complete data on the good and bad points of the new canes.

The second group comprises stations which are willing to do all they can to test and spread the new canes but are unable to do so for a variety of reasons, such as lack of adequate staff, time or space for properly carrying out the tests, or inadequate facilities for getting an intimate knowledge of the canes in cultivation in the locality. In some of these, the cane is one among the many crops needing the attention of the staff employed, with the result that it does not receive adequate attention.

There is a third group of stations which, for certain reasons, are not very keen about the Coimbatore canes.

There is thus seen to be a considerable amount of difference both in methods and in the standards adopted, by the various testing stations. When it is remembered, that the testing in the Provinces is the more important test in the selection of the improved seedlings, the disadvantage of the present arrangement would be obvious.

The remedy for the present state of affairs lies, in the opening of sub-stations in every major cane tract under the control of the Coimbatore station by the Imperial Department of Agriculture. The sub-station would be needed for each cane tract irrespective of the political boundaries as to Provinces. These sub-stations would carry the work a step further forward, *i.e.*, to the end of selection of the seedling for the locality and up to the distribution of the cane to the cultivators in the tract, which latter activity is best left to the Provincial Department of Agriculture.

There would be another very important advantage resulting from the founding of the sub-stations mentioned above. For the breeding work at Coimbatore to be carried on at its best, a considerable amount of knowledge is needed about the conditions of growth obtaining in the locality and a personal touch with the improved seedlings as they spread into cultivation. The founding of the sub-stations will secure both these conditions. Sugarcane is, generally, a paying crop and, if properly run, the testing station should be able to remit back as receipts, a fair portion of the monies expended on it. The sub-stations would be in a position not only to recommend the Coimbatore seedlings most suitable for the locality but supply besides a fair amount of material of the recommended seedling.

The proposed sub-stations should seek the full patronage and support of the provincial departments, because the satisfactory working of the sub-stations would depend a great deal upon the hearty co-operation between these and the Agricultural Department in the Province.

QUESTION 3 (d).—A striking instance of effective demonstration and propaganda is afforded by the work of the Sugar Bureau at Pusa in spreading into Bihar the improved Coimbatore canes. The Bihar work has further been partly responsible for attracting the attention of certain of the other Provinces to the merits of the Coimbatore productions.

The main feature in the work was the large scale tests which were carried out in the fields of the planters themselves. Besides being on a large scale, the tests were complete and based on results obtained by passing a full and sufficient quantity of cane through the factory and comparing the improved cane with the local variety in all its aspects from the sowing to the obtainment of

the finished product in the form of sugar. The thoroughness of the tests readily carried conviction to the planters who quickly adopted the new canes.

When the cultivator sees a demonstrated crop in a Government farm, he sees along with it costly machinery and other equipments—though these may be there purely for experimental purposes—and leaves the farm with a shrewd suspicion that the good results have resulted from other causes besides the ones mentioned. On the other hand, if he notices an appreciable difference in favour of a new variety in his own land and with cultural operations carried out by himself he readily takes up the improved strain.

Two other contributory factors to the success of the Pusa work have been (1) the presence in the locality of an enlightened set of planters who had given up the indigo crop and were eagerly on the look out for another to replace it and (2) the personal keenness of Mr. Sayer, the officer in charge, in pushing the new Coimbatore canes into cultivation.

Enlightened planters like those in the white sugar belt of Bihar are not generally available elsewhere. It is my experience, however, that the ordinary cultivator is not quite as conservative as he is at times represented to be. Once he sees a good thing and sees it in a manner which readily carries conviction to him, he sometimes goes even beyond the limits demanded by caution. I have had such experiences in connection with the improved Coimbatore seedlings.

QUESTION 4 (a).—A greater co-ordination of agricultural research in the Provinces, than is available at present, is desirable. I have known instances of experiments started in a Province, without any idea of the results as obtained from the same experiment elsewhere. I am not against the same experiment being conducted in more than one Province. The variations in climatic and other factors, that are found within a continental country like India, render such experiments useful and desirable; a greater touch between the workers will conduce to greater efficiency and quicker results.

With the steady advance that is being made in the direction of provincial autonomy, the Provinces are likely not to support, if not to resent, any central organisation other than of a purely advisory character. To be useful, any central organisation should be so developed as not to suggest any idea of domination or dictation to the Provinces in the matter of agricultural research. With the Reforms the situation needs a rather delicate handling. Facilities for a more frequent meeting in conference of experts working on the same subject, and a small central board consisting of experts as well as of the leading interests in agriculture and allied industries, might meet the situation. The touchiness of the provincial departments should be satisfied by including in the board senior men from the Provinces as well. Such a board need not necessarily involve much additional expenditure, as the members could be made to serve in an honorary capacity. This board could periodically get the programmes of work from the various Provinces and might function both for co-ordinating research and for offering advice on matters of importance.

(b) The department under the Central Government should be so developed as to carry a full complement of expert staff in all the branches of agricultural science. It is true Agriculture is a Transferred subject in the Provinces and rightly so after the Reforms. Many of the problems dealt with in the Provinces are best studied in the localities themselves. The scientific officers in the Provinces are apt to be pre-occupied with local needs and work with a view to comparatively quick results. Research into the fundamentals of the problems involved is best tackled by a central department.

There are certain problems such as "The Indian Sugar Problem" and the rather important work of "Plant Introduction" which are best handled by the department under the Central Government.

The data here given, would show that the improvement of sugarcane varieties in India could not have been done efficiently by any agency other than a central department. Some of the poorest canes in India are those found in the unirrigated tracts of the Punjab and the largest cane area in India is in the United Provinces. The sugarcane does not flower in either of these regions.

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but does so freely in the Madras Presidency in South India; and, in this Province, the cane occupies but a subordinate place among the crops of the locality. The regions most to benefit from cane breeding are thus precluded from undertaking any work in this direction; whereas, the Province in which the cane flowers freely, would not feel justified in going in for any large expenditure on the crop. If the Central Government had not started the Coimbatore Sugarcane Breeding Station, it is difficult to see how else the improved seedling canes for the Punjab, the United Provinces and Bihar would have been secured; very likely the work would not have been undertaken.

The Central Department, while primarily intended for the country as a whole, should be able to bring its superior resources to bear on any particular problem which might have become suddenly urgent and important in any of the Provinces. Any existing indifference of the Provinces towards the central department would disappear after a few definite demonstrations of help and co-operation to the Provinces as indicated above.

It is purely an accident that Pusa in Bihar happens to be the headquarters of most of the agricultural research work under the Central Government. There are certain problems which are better studied in localities other than Pusa. When such a problem arises, the central department should be able to found a station in the Province and carry work on its own account. The location of the Imperial Sugarcane Breeding Station at Coimbatore is a striking example of the usefulness of such an expansion.

(c) (i) The services rendered by the Indian Agricultural Service are satisfactory, though capable of improvement in sundry directions. The recent Indianisation of the service—that has followed from the recommendations of the Lee Commission—has not in my opinion detracted from its efficiency.

Indians in the department have at the start relatively more difficulties to contend with. For one thing their work takes longer time for getting recognition in the country. I know of instances, where such work received recognition outside the country earlier than within it. So long as the Indian recruit is properly and carefully selected, there need be no fear of loss of efficiency.

It is hardly six years since anything like an effective Indianisation was initiated and that too in but a few of the Provinces. To condemn this policy as leading to inefficiency within such a short period is totally premature. Even new sugarcane seedlings need a longer time to judge of them with any claims to accuracy.

Greater opportunities should be given to the officers of the department to see work elsewhere both within the country and outside of it by affording such facilities as deputation and study leave.

Any foreign training needed for recruits into the Indian Agricultural Service is best given after some service within the country. This would enable the individual to get a good grip on the problems that he will be faced with after his return to the country. The Indian Universities are rapidly developing in equipment and efficiency and the need for foreign training would steadily disappear with the advance of time.

The short-term system of recruitment is not of general utility in the case of the Agricultural Department. It would involve greater expenditure to the State without compensating advantages. Its use is confined to cases where a costly specialist has to be employed in connection with problems which are capable of solution in a comparatively short period of time. The problems presented to the agricultural researcher often need a long period of attack for their proper solution.

QUESTION 9 (a) (i) AND (ii).—With the progress in breeding, a new line of work would appear to have opened out in connection with the reclamation of waste or alkali lands. A sugarcane seedling obtained at Coimbatore by hybridisation with a wild grass, has shown a marked capacity to grow under adverse soil conditions; the ability has apparently been derived from the wild ancestor.

The reclamation of waste and alkali lands could now proceed from two directions; one, by acting on the soil and second, by breeding a strain which

would grow under adverse soil conditions. Certain root studies by the writer have shown a definite promise in this direction. Once a barren land gets accustomed to vegetation, of however poor a quality, it would appear to be easier later on to accustom the land to more remunerative cropping.

QUESTION 11 (a) (i). I would urge the appointment of crop specialists in the case of the more important crops in the country. It is only at the hands of such a specialist that the crop would get the attention it needs. The pure scientists have often a tendency to look at the crop piecemeal and from the view point of their own science. The crop needs to be studied as a whole for rapid progress in its improvement under cultivation.

(c). A striking example of successful crop improvement through breeding is afforded by the work of the Sugarcane Breeding Station at Coimbatore. This day and within about a dozen years after its founding by the Central Government, its productions are rapidly spreading into cultivation in every Province to which they have been distributed. The published departmental reports are replete with references to their merits.

I have made an attempt, to obtain from the District Officers, an idea of the increased money value resulting from the spread of the improved Coimbatore canes in place of the indigenous varieties. The figures for the last season are :—

- (1) An increased profit of a lakh and a quarter of rupees in Bihar.
- (2) A lakh in one circle in the Punjab.
- (3) A third of a lakh in one circle of the United Provinces.

It is just nearing four years since the Coimbatore canes got into cultivation and the above figures are bound to increase very rapidly with the advance of time.

One of the Coimbatore productions—Co. 281—has shown “extremely favourable results both as regards tonnage and sugar contents” in Cuba. It is said to have stood “easily the first in sugar” and “very high in tonnage”. It is thus possible that, as time advances, the utility of the Coimbatore work may extend beyond the limits of the country.

QUESTION 13 (i). The Act now in force against the importation of sugar-canes from foreign countries is fairly adequate, though there exist possibilities of evading the Act in sundry ways. A quarantine station, for receiving new introductions and growing them for a period under strict control before passing them into cultivation or for breeding, is likely to be needed in the near future. Most of the other cane countries of the world now possess such a station.

(ii). The breeding of disease resistant strains opens out a new, efficient and promising line of work for protecting crops against infection from any particular disease.

QUESTION 17 (d). The Indian Sugar Committee recommend the starting of a model sugar factory by Government in a suitable place (*vide* page 330 of their Report). At present Indian capital is rather shy of investment in sugar concerns. The establishment of a Government factory, carrying on research work on the various operations, and the publication of reliable data from time to time will stimulate the flow of capital into such concerns. This is a necessary step to make India self-contained in the matter of sugar.

Oral Evidence.

A.549. *The Chairman* : Rao Sahib Venkatraman, you are the Sugarcane Expert to the Government of India?—Yes.

A.550. You put in a very interesting and instructive answer to the Questionnaire issued by the Commission. Would you rather make a statement of a general character at this stage or shall I proceed to question and answer at once?—I have no statement to make.

A.551. The Commission has of course in mind the very interesting exhibition which you arranged at the sugarcane station the other day?—Thank you.

A.552. And we are also grateful to you for all your arrangements. Would you give the Commission quite shortly the story of your professional training?—I am a Botany graduate of the Presidency College at Madras, having been a prizeman and placed in the first class. After that I had about 18 months' training as a post-graduate scholar in the same college; I was drafted into the Agricultural Department under Dr. Barber who was then the Government Botanist. I entered the department in the middle of 1907 and I had experience of teaching for one year. From 1908 to 1912 I was doing research work on various crops as cotton, *gogu* and also certain garden plants like *mirabilis* and other plants under Dr. Barber. In 1912 when the Government of India were starting the Imperial Sugarcane Breeding Station, Dr. Barber selected me to work under him and with him. I have been associated with Dr. Barber from the very commencement of his experiments on sugarcane breeding. I might perhaps mention that experiments were started in sugarcane breeding a year earlier than the creation of the post of Government Sugarcane Expert itself; because even as Government Botanist, Dr. Barber devoted attention to this work. It was certain preliminary results, obtained, even before the Sugarcane Station materialised, that induced the then Board of Agriculture to definitely recommend the starting of a Sugarcane Station. From 1912 till 1918 I have been working under and with Dr. Barber in connection with cane breeding. From 1918 onwards I have been in independent charge of the station. That brings it up to date.

A.553. To proceed at once to the central point of your proposals, I understand from your memorandum that you look with favour upon the setting up, in every major sugarcane tract, of stations linked with this Coimbatore Station, I suppose under the general direction of yourself, each station applying itself to the immediate problems of its own district?—Quite so. Only, the sub-stations which I have in mind are intended to grow the seedlings produced at this place and carry the work a step further. If I may explain, at present, sugarcanes do not flower in Northern India and therefore the seedlings have to be bred at Coimbatore. From here we send only setts or cuttings and this station being far removed from the main sugar tracts of this country, the selection made here has to be of a preliminary character; we dare not reject too many, for fear of losing some which ultimately may prove of use in the Provinces. The sub-stations, which I am contemplating, would grow these seedlings, look after them and carry the work of Coimbatore a step further. I expect, these sub-stations would shorten the work of this station by about four to five years in the attainment of results in the Provinces.

A.554. I seem to see also in your note of evidence some indication that you are not perfectly happy in your own mind as to how this proposal, which you have been enlarging upon, would be received in the Provinces within whose boundaries these stations will be situated?—I do not expect any difficulties so long as the Provinces are not asked to provide the funds.

A.555. You think that, if you are allowed to exercise your tact, and provide the funds, you will overcome all resistance?—I should think so.

A.556. I want this from you in particular; in your view is the fact that this is one of the few districts in India, where sugarcane will flower, a reason.

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for breeding that crop in a different fashion from the standard methods, according to which, you would suggest dealing with other crops?—Yes, it is so.

A.557. So that, if I have made my question clear, you would not suggest central research or plant breeding stations reproducing themselves in every typical district throughout India, as organisations financed by and responsible to the Central Government. You would not suggest that as to crops other than sugarcane?—Not on the breeding side, no.

A.558. On the research side you would?—I should suggest Central Government Stations.

A.559. Central Government Stations?—Central Government Stations with regard to some of the major crops, to go into the fundamentals of the problems involved in connection with the improvement of each crop.

A.560. You are impressed with the success of the principle of organising research crop by crop?—Yes.

A.561. What do you think of the work of the Indian Central Cotton Committee in that respect?—I am not much acquainted with the work of the Committee; I hear it is doing very good work, but I have no direct touch with it.

A.562. I should say from certain internal evidence in your note that you have applied yourself in some detail to the system of organisation as between the Federal Department and the State Departments in the United States of America, am I right?—Yes.

A.563. Do you like the plan as it is working in America?—Yes, that is the idea.

A.564. That plan involves the spending of Central Government funds partly in Central Government Institutions and in the Provinces or States as in America, and even in institutions owned and conducted by the Provincial Services?—Yes.

A.565. Experience has shown that co-ordination in America is essential and so inter-state jealousies and the natural jealousy of the Federal Department towards the States or of the States towards the Federal Department has been overcome in the interest of agriculture as a whole?—Yes.

A.566. You would not suggest a system such as that in every detail for India, would you?—Not in every detail but in the broad outline.

A.567. You would?—Yes.

A.568. This is the point we are concerned with. Would you suggest the spending of Central funds in provincial research institutes?—I do not think there is any harm in it.

A.569. Do you know that in America when the Central Government so spend money, they claim and exercise the right of inspection?—Yes.

A.570. And you do not mind that I should like to have that privilege for the Central Department, but I do not know how the Provinces would receive it?—But so long as a certain amount of money is provided by the Central Government I expect no difficulty.

A.571. You are impressed with the importance of co-ordinating research work on crops throughout India?—Yes.

A.572. And you regard these problems as All-India problems and not as mere provincial problems?—Yes.

A.573. Have you any idea how funds might be made available for the Central Government without which co-ordination with the Central Government would not be attractive to the Provinces?—I have not thought about that.

A.574. Without taking you through the details of your note, or the work that you are carrying out, the Commission would like to have on the notes your own views as to the reasonable probabilities of improvement in sugar yields in India in the measurable future?—For a long time it was considered by sugar authorities, that the Province of Bihar, where are centralised almost all the important Indian sugar factories, was not likely to be able to grow a decent variety of cane. But the breeding work that has been done at Coimbatore has

shown that, even in that Province, we could grow crops perhaps as good as Java. That being the case, I am indeed very optimistic about the future position of sugar, provided Government and the legislatures guarantee the necessary facilities.

A.575. By that you mean the funds for carrying out work?—Funds for carrying out research and also, if necessary, any protection to Indian sugar. In this connection I would like to say that some of the other countries in the world have had a start over India of about 60 or 70 years so far as sugar production is concerned. It will take sometime before we are able to get our factories up to anything like the standard of other countries. As an infant industry it is just possible it may need a certain amount of special protection from Government.

A.576. What proportion of the refined sugar consumed in India is imported? Can you say approximately?—I know the value of the imported sugar, but I cannot give the exact proportion.*

A.577. Are you sure that a very important proportion of the refined sugar consumed in India is imported?—It is imported; in fact the money value of the imports in sugar comes almost next to clothing.

A.578. So that an import duty on sugar would have the effect of raising the cost of refined sugar to the consumer; that is your intention, is it not?—Yes.

A.579. Is it your idea, that a demand would spring from that cause, which would lead to more Indian sugar being refined, or are you thinking of a bettering of the *gur* market?—I do not very much like anything which would lead to an expansion of the refining of the indigenous *gur* because it leads to considerable waste; I should like to see development in the direction of more factories producing sugar direct from cane.

A.580. In making your recommendation for a protective duty, you have yourself fully considered the rather difficult economic problem as to whether any duty of that sort would assist the grower of sugarcane in this country, since the cane which he grows is in the main converted, not into sugar, but consumed as *gur*?—Yes.

A.581. Do you think it is a complicated problem?—Yes; it is a complicated problem.

A.582. Have you fathomed it fully yourself?—No.

A.583. On my original question, you do look forward with confidence to a very considerable increase in the yield of sugar per acre?—Yes, I would quote the instance of Java which has been able to treble its yield per acre within 60 years. I do not see any reason why in India we should not be able to do it; our station has shown that it could be done.

A.584. Do you think Indian sugar production will require protection or subsidy or some such crutch for all time, or do you think there are conditions which at this moment favour foreign competition?—This protection will certainly be needed only for a short time, because I see that in India we have greater facilities, probably, greater than in certain other countries of the world, so far as the cost of production of a ton of cane is concerned.

A.585. Have you studied the conditions in Java?—I have not been there.

A.586. But you have read literature on the subject?—Yes.

A.587. Do you think that natural conditions there, apart from the act of man, are very much more favourable to the growth and better yield of cane than are conditions in tropical India?—It is rather a controversial question, but my own personal opinion is that our conditions are such that we should be able to produce in India sugarcane cheaper than Java.

A.588. So that, all you are asking is some assistance for a limited time so that you may have the opportunity of establishing improved conditions?—Yes.

*About 87 per cent of the refined sugar consumed in India is imported from abroad.

A.589. How much do you hope for from the improvement in extracting and manufacturing processes?—If the modern sugar factories were to be in operation in all places where at present *gur* is made (by *gur* I mean the indigenous crude product) on a rough calculation we shall have 30 per cent increase in extraction of the juice from the cane. There are, however, difficulties against the starting of modern factories everywhere.

A.590. Extraction by better machinery?—By factory machinery in place of the machinery used by the cultivator.

A.591. Would that give an increase of 30 per cent in the yield of sugar?—We are losing 30 per cent at present.

A.592. *Sir Henry Lawrence*: Sugar or juice?—30 per cent of juice.

A.593. *The Chairman*: Is that the same thing as 30 per cent of sugar?—No, because in the method of manufacture we are again losing perhaps another 15 per cent; so that we are losing at least 40 per cent. because of the crude methods of manufacture adopted by the cultivator.

A.594. You are doing your best to do your share in the way of improving varieties of cane?—Yes.

A.595. Do you think that other people are doing their share in the way of improving the processes?—Almost all the Provincial Departments are now engaged in effecting improvements upon the manufacture of the crude product, that is *gur*; but I do not think there is much activity towards the establishment of modern factories.

A.596. How do you account for that lack of activity?—For one thing a factory means a lot of investment of capital; that is why I advocate, towards the very end of my note, the establishment of a Government factory which would be able to publish reliable data. I believe that is likely to encourage the flow of capital into sugar concerns. At present Indian capital is rather shy of going into sugar concerns.

A.597. You do not think that anything in the nature of a duty would remove the stimulus to some extent which tends to promote improvement in processes?—In fact, I should be very careful in deciding what duty to put on and for what period, because if the duty be too prolonged, our factories will continue to be inefficient. Within recent years I have reliable information to show that the factories have greatly improved from 6 per cent extraction to almost 9 per cent.

A.598. In saying that of course you are assuming that your notion is right that a protective duty will in fact afford certain help?—Yes.

A.599. Although in conversation just now you agreed with me that that was a very difficult matter to decide?—It is a difficult matter.

A.600. Can you tell the Commission what proportion of the total area under sugarcane is under Coimbatore canes to-day?—It is difficult to give anything like accurate figures, but I can quite easily give the money value, because I have gathered that information from the district officers. The acreage I would put roughly at at least 12,000 acres; that is very rough.

A.601. Twelve thousand acres under Coimbatore canes?—Yes; that is the sure minimum figure, a figure of which I am quite sure; it may be more; it is a very conservative estimate.

A.602. What is the total acreage under cane in India?—In the whole of India it is 2½ millions of acres. In this connection I have to mention that it is hardly three or four years since the Coimbatore canes got into cultivation, and as in all these cases the increase hereafter will be very rapid, the proportion next year may be five times this year, the year after it may be five times that again, and so on.

A.603. That is all cane bred here?—Yes.

A.604. There are certain areas for which you have not yet bred suitable canes, are there?—Yes.

A.605. You hope in the future to meet that demand?—Yes.

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A.606. You are, officially, in the position of being a guest in the Presidency of Madras, are you not?—Yes; a sort of guest.

A.607. Do you suggest that you are paying something for your board?—Yes, I have just started paying for my board, because the Government of India have given me 38 acres to start work on the type of canes suitable to the Madras Presidency. I have always been in an awkward position, because my visitors are all from Madras Presidency. These visitors come to me and ask whether I have bred any cane suitable to their areas, and when I say all the cane is for the Punjab and Northern India, they say “you are a useless fellow.” Hereafter, I am glad to say I will be able to show them cane suitable for Madras and Bombay.

A.608. You are now mending your ways and you are going to try?—I am trying.

A.609. I understand that Madras is also moving, and that they propose to set up their own cane breeding station?—Not a cane breeding station, but a cane research station.

A.610. Not a cane breeding station; they will depend upon you for that?—They will.

A.611. You think so?—They have to, more or less. With regard to sugarcane I am in rather a fortunate position, and that is there are so many cane localities in Northern India where sugarcane will not flower, and there are other places like Bombay and North Madras where it will, but do not produce fertile seeds; and I am not sorry for that.

A.612. But after all, you are not against other Presidencies setting up their breeding stations?—I do not mind.

A.613. I am only trying to get at the facts?—I do not think they will.

A.614. Is it agreed between you that they will depend upon you for breeding?—I think they will.

A.615. There is nothing fixed in writing?—No. In fact there is, I think, already an informal understanding. The Deputy Director has already sent up proposals to the head of his department in Madras in connection with the sugarcane research station. We have an informal understanding and we have agreed between us that I should do the breeding and he should do the rest.

A.616. How came it that you tackled the requirements of Northern India before you tackled the requirements of Southern India?—Because the bulk of the area is in Northern India. The total acreage in India is roughly 2½ million acres, of which half a million is in the Punjab, half a million in Bihar and Bengal, and 1½ million in the United Provinces. Therefore I am trying to produce cane for a tract that is growing 2½ million acres out of a total of 2½ million acres; there I am perfectly justified. In the beginning, if you will permit me to say it, we wanted to make an impression as soon as possible on the Indian sugar problem. My station was in the first instance sanctioned for five years; if I did not show any result I would have had to go. Then, it was sanctioned for another five years. Therefore, we were anxious to show the maximum result within the shortest time, and we did show a definite result within eight years of the founding of the station.

A.617. Are you hopeful of making any substantial contribution to the sugarcane problems of Southern India?—Situated as I am at present, I do not propose to tackle any of the other problems pertaining to Southern India; but if I am wanted I could do it.

A.618. Provided you are given the staff and the money?—Yes.

A.619. Have you adequate staff to deal with that at the present moment?—No.

A.620. *The Raja of Parlakimedi*: Has a geographical survey been made of the sugarcane producing areas in India?—In the Statistical Atlas there are published figures showing the acreage of cane in every Province and in every district throughout India.

A.621. Roughly, what is the area?—2½ millions in the whole of India.

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A.622. What is the area in this Presidency?—It is about one-tenth of a million.

A.623. What is the area at present under cane, both of improved varieties and indigenous varieties in this Presidency?—I have not been doing any work for Madras until now.

A.624. The figures have not been supplied to you. Are they available?—The figures are available, but I did not interest myself in those figures because I was not doing any work for Madras.

A.625. Are you in touch with other parts of the world where sugarcane is grown or sugarcane research is conducted?—I am in touch through correspondence the work done at Coimbatore has now attracted world-wide attention; other people who are working in the same line are corresponding with me; that is the only touch. I have never been outside India.

A.626. But you are taking advantage of the research work done in other parts of the world?—Of course; I am feverishly trying to get all the information I can from all over the world.

A.627. When you are creating these different varieties of canes, what are the main factors to which you pay attention?—At present, I am concentrating most attention on what may be called the tonnage of cane per acre. Other things being equal, the tonnage of cane per acre, that is the quantity or weight of cane cut per acre, is the main thing.

A.628. What about the sucrose in it?—I try to make improvements on sucrose also, but I think the best way of producing early results is to work on a tonnage basis. Of course, I see that the quality I produce is not worse than the quality we already have.

A.629. So that you have not succeeded in improving the proportion of sugar from the cane?—No; I mean the total quantity of sugar produced per acre from some of my canes will be two and half times the quantity raised from local canes; I have the actual figures.

A.630. What about the proportion of refuse, when compared with indigenous canes?—As far as the canes which are now spreading in Northern India are concerned, in some cases the refuse is more, and in some the refuse is less. In fact, I have had complaints with regard to certain of my canes, that they were too good in that they did not give enough fuel. My reply was "I am trying to breed cane for sugar and not for fuel."

A.631. Have you successfully tackled the well-known diseases, such as stemborer, redrot and so on?—I have nothing to do with diseases, though I have tried to get a knowledge of them; I am not directly working on diseases.

A.632. Do you not think it is an important thing?—I am working more on the lines of producing varieties resistant to disease.

A.633. But it is necessary to know the life history of the diseases?—I do not know the life history of the diseases in detail, but I know the main factors of certain of the important diseases.

A.634. Then, in a way, you do tackle the difficulty?—I do, from the breeding point of view.

A.635. So far, is anybody in Southern India taking advantage of this station?—I would not exactly say that they have taken advantage of it. I have not been doing much work for Madras yet, but even now one of the canes produced originally for Bihar has done well at Anakapalle, and I read in one of the monthly digests published by the Agricultural Department, Madras, that Co. 213, which is popular in Bihar, has been found to be useful as a drought-resisting cane at Anakapalle.

A.636. But you do not entirely close your doors to Madras demands?—No. I am like a merchant who has got wares for any kind of customer. It is for the customer to choose whatever he wants; I am trying to increase the range of my wares. I have got the cane, which needs large quantities of irrigation, the planter's cane, the rich man's cane and the cultivator's cane; that is my idea.

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A.637. *Sir James MacKenna*: Do you think there is any scope for the medium Coimbatore canes, such as Co. 213, in the Bombay Presidency?—I think it is distinctly worth a trial.

A.638. Have they not tried them yet?—Not yet.

A.639. Why not?—The farm at Manjri does not easily favour a cane which is thinner than the Pundia cane to which they are accustomed; but I think it is distinctly worth trying.

A.640. Because Pundia requires very heavy manuring and heavy cultivation, and therefore it is not a poor man's cane?—Co. 213 is not a poor man's cane.

A.641. It is a luxury cane?—It is the ordinary cultivator's cane; in fact, it will probably require much less water than Pundia itself. In this connection, I might mention that Java which once plumped more on the thick canes is now turning towards medium canes, and if the ryot wants a sure crop, my canes will help him better.

A.642. Have the Bombay Government approached you to provide them with improved varieties of canes?—If I may say so, that is one of the Provinces, I am sorry to say, which has not been very cordial towards Coimbatore.

A.643. Barring a few exceptions, are all the Provinces assisting you in conducting tests of your canes adequately?—I would not say all the Provinces. Most of them are.

A.644. Have you had any refusals from any other Province or have they shown lack of interest?—It is not exactly refusal; want of cordiality is enough. For example, these canes have to be tested, and unless the local officer is very cordial, I should think twice before giving him a cane of whose merits I am not certain. If it does not turn out satisfactory, he will at once say, "The Coimbatore man has given this cane and see what has happened to it"; therefore, they must be absolutely cordial.

A.645. So that the lack of cordiality is an incentive to produce a higher standard. Are you co-operating in your main research work with the Scientific Section at Pusa?—Yes.

A.646. Both Mycological and Agricultural?—Yes.

A.647. What about your successor? Is that not an important matter?—Yes.

A.648. It is a very important matter; what arrangements are being made for a successor capable of carrying on your work at the same high standard?—There is a second officer, who has already joined; he joined six months back, and if I live up to 55, he will be working with me for 12 years; that is quite ample, I think.

A.649. Are you going to send him to Cambridge, or are you going to keep him in your own hands?—That again, is a point; sugarcane breeding differs in essential respects from other crops; there is no question of Mendelian ratios to speak of. We are just beginning to have indications of Mendelian ratios; only six months back we got something like an indication. I do not think a visit to Cambridge would be of much use.

A.650. That is your personal view?—That is my personal view.

A.651. So that, you think, with 12 years' training this man will be able to carry on the Barber and Venkatraman traditions?—Yes.

A.652. *Sir Henry Lawrence*: What has been the effect of recent changes of price on the area cultivated for *gur*, either in this Presidency or in other parts of India?—I have not studied that question much; I should not like to hazard any figures except this general statement that the area sown varies according to the market price of *gur*.

A.653. You have shown us some very interesting charts, giving the importation of Java refined sugar, and I understood that you wished to have measures taken which would reduce that importation?—Yes, and stop it ultimately.

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A.654. On the ground, amongst other things, that it caused a large efflux of money from India?—Yes.

A.655. Rs 15 crores?—Yes, 15 crores is the average for ten years.

A.656. Since you prepared that chart, which gave an importation of 450,000, the importation has in fact gone up to 700,000 tons?—It has.

A.657. Is there any office from which we can obtain information to show what is the effect of this importation of refined sugar on the cultivation of cane by the ryot?—The only office I can think of, which might give this information, is the Sugar Bureau at Pusa.

A.658. The price of *gur* has been fluctuating?—It has.

A.659. In this Presidency?—Yes.

A.660. Does it fluctuate in any relation to the price of imported refined sugar?—It does.

A.661. Can you establish a relationship?—There is a general relationship between the price of *gur* and the price of sugar in the market.

A.662. So that, large importations of Java sugar are likely, in your opinion, to reduce the price of *gur*, and thereby reduce the incentive to the cultivator to grow sugarcane?—Yes.

A.663. You have no very definite opinion on the point?—No.

A.664. You have not worked it out?—No.

A.665. Nevertheless, you are now proposing a protective duty against refined sugar?—Yes.

A.666. On what do you base that proposal, if it is not for the protection of the cane cultivator?—It is for the protection of the Indian sugar industry, which includes the cane cultivator as well as the factories that may come into being.

A.667. But the factory industry in India, you will agree, is very small as compared with the interests of the cane cultivator?—I should like to see the factory industry grow. Unless we expand the factory industry, we will continue to lose in the manufacture, and all the good work done in other directions will be lost. In these days, it is impossible to go on producing sugar under the old methods, because they are wasteful methods of manufacture; we have to be up to date, we have to be abreast of the world.

A.668. Do you find, then, that in this matter of waste, you are against factories which are making refined sugar from *gur*?—Yes.

A.669. Is that the practice in any factories?—No, not in many factories in Northern India.

A.670. Do they not make their refined sugar direct from the cane?—Yes, in Bihar most of the factories make sugar direct from the cane; that is the economical way of producing the sugar.

A.671. What is this waste that you complain of?—It is like this; if you had a ton of cane and produced sugar direct from it, you would get much more than if you had the ton of cane converted first into *gur* and from the *gur* into sugar.

A.672. Quite true; but where do you find this refining from *gur*?—Even here, in Madras, there are one or two factories which are doing the refining from *gur* on a small scale; there is one at Samalkot, there is one at Tinnevely and there is one at Unao.

A.673. Is that a large proportion of the total amount of refined sugar made in India, that is, of 100,000 tons? How much of that is made from *gur* and how much from the cane?—I do not know the accurate figures, but it is not a very large proportion.

A.674. Talking of this Coimbatore cane in its applicability to Bombay canals, you say that the Manjri farm has not been very cordial towards your cane; does that mean that they have reported that your cane has not done any good?—Not exactly that.

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A.675. That would be lack of cordiality; would it not?—I would not call it that. If they really found it bad and threw it away, I would have no objection. I am producing every year 2 lakhs of new varieties, and the bulk of them will be thrown out somewhere; I do not mind.

A.676. You complain that they have not tried your canes?—I might probably mention the actual case. When I go up to Manjri farm sometimes I am not allowed to go through their cane crops except with the officer and in one instance I had to wait two days sending out telegrams, doing nothing; I was at the Manjri farm but could not see the canes.

A.677. What is the year?—I do not remember the exact year.

A.678. Is it five years ago, ten years ago?—Probably about six years ago; it is probably better not to give the exact date.

A.679. That discourages you from going on?—Yes.

A.680. *Sir Ganga Ram*: In your experiments do you keep a record of the water that you use? What quantity of water do you use?—We do not carry out any definite experiments on the water requirements of the sugarcane. But on this Coimbatore station I am using something like 100 or 120 acre inches of water.

A.681. How much water do you require for 100 acres?—Our figures are on acre inches as we call it. In an irrigation, if the cultivator allows an inch of water to stand in the field, it is called an acre inch. It is based on something like the rainfall.

A.682. You use how much water, 100 to 120 acre inches?—Yes.

A.683. Do you know that in Bombay your cane is not making any headway?—Not yet.

A.684. Why?—The Bombay people are quite accustomed to the thick type of cane and the canes I have bred so far are all either thin or intermediate. I have yet no thick canes bred from the Coimbatore farm to give them.

A.685. Why have not the United Provinces, who are chiefly sugarcane growers, taken them up?—They have; the Coimbatore canes are spreading rapidly in that Province.

A.686. They are spreading?—Yes, and with the advance of time they will cover every acre there almost.

A.687. You are not charged for water here?—No, because it belongs to Government.

A.688. It is free?—We pump most of our water from the wells. I have to pay for the pumping; I have an oil engine.

A.689. The ryot also does that. In certain places where they have facilities for working from the canal, water-rate is charged. How much are they charged? That is what I want to know?—That I cannot say. In my farm I do not use much canal water.

A.690. Do you grow any coarse paddy which harvests in two months?—Paddy is not my line.

A.691. You do not grow any sugarcane which matures in two months?—I have not heard of a cane like that.

A.692. What do you advise the people to grow after you take the sugarcane off the ground?—I would not advise them because I do not know the local conditions.

A.693. What is the practice?—That differs in various places.

A.694. Do they put sugarcane after sugarcane?—No.

A.695. They do not?—No.

A.696. They put something else?—Yes. They put something else generally.

A.697. They do not put cotton? The best thing is to put cotton?—No: they do not.

A.698. Can you tell me with regard to a crop of sugarcane, what chemical properties does it take away from the soil?—I have not worked in that line.

A.699. *Sir Thomas Middleton*: You gave us the opportunity of seeing your work. You pay very great attention to the root development of your cane?—Yes.

A.700. It is from the root development that you judge whether cane is suitable for light soil or heavy soil?—Yes.

A.701. You have already indicated that you are growing an intermediate or thin type of cane. What is your ideal diameter in your intermediate cane? What size are you working on?—Somewhere between $\frac{3}{4}$ inch and 1 inch.

A.702. For your thin cane, what standard do you take?—Less than $\frac{3}{4}$ inch.

A.703. What height do you work up to? What is your ideal height for these different types?—That again is rather a complicated problem. It all depends upon the locality. If I want to introduce a cane to a locality where there are high winds I would not try to produce a tall cane. I would rather make up the tonnage by a greater number of canes to the field; it all depends upon the locality.

A.704. I expected that type of answer. But I was going to ask you what are the limits between which you work? For these districts where the winds are high you would select canes how many feet in height?—I should like to put it as low as 12 feet, but at present probably it is practicable to put it at about 15 feet high.

A.705. For districts where the winds are high?—Yes, 15 feet.

A.706. And how many canes from the stool do you consider sufficient?—That again depends upon the locality and upon the amount of seed I can get to the acre. I would on an average put it at about 8 to 12 canes to the stool.

A.707. What I was getting at is this; certain of your canes are free tillering varieties and certain are not?—I have both types.

A.708. For those localities in which you have high winds you want a free tillering variety?—Yes.

A.709. And a free tillering variety you describe as 8 to 12 to the stool?—I would rather put it at 12 to 15 for very free tillering varieties.

A.710. Let us now take the other extreme, the locality in which you want a tall cane. What size do you aim at?—It may be anything, in fact over 20 feet.

A.711. What is the maximum height of the Java canes? Can you tell us?—By the cane I must here mention I mean to the tip of the leaf.

A.712. Yes; what is the maximum height you know of the Java canes?—There are some Java canes which are only about 12 feet. There are other Java canes from 12 to 15 feet. Some of them are even 20 feet.

A.713. For certain districts you are growing much taller canes than the Java canes?—Yes.

A.714. When you grow the taller canes what amount of tillering do you want?—If it is a very tall cane, I would not go beyond four or five tillers.

A.715. Even in the places for which you are now working you have quite a number of different qualities to satisfy?—Yes.

A.716. Although you have as yet done very little for Bombay?—Yes.

A.717. Now coming to the next point, when you are making a cross how many fertile seeds do you aim at getting from one cross?—A sugarcane has got a very large number of flowers and in one pollination I can pollinate all.

A.718. But you do not do that, do you?—I do it on four different days.

A.719. Then you get from each process a very large number of seeds?—A very large number.

A.720. Do you actually grow all the seeds?—Up to about six weeks, all of them.

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A.721. How many crosses do you make in a season?—It all depends upon the nature of the season. In a favourable season I make about 30 or 40 combinations. The number of crosses will be more.

A.722. How many thousands of seedlings?—I generally raise every year about 2 lakhs of new seedlings.

A.723. And is it the case that no one seedling is identical with its neighbour?—I have got accurate data with regard to a particular sowing where from a single flower, that is without any foreign pollination, we grew 2,700 seedlings and no two of them were alike. We described them with 30 or 40 botanical characters and none was like the parent.

A.724. You have got, we understand, a monopoly of the seedling raising business, but your monopoly provides a wide range of varieties. You ought to be able to provide every customer with suitable wares?—We are trying to do so. I am quite optimistic about it.

A.725. What you are anxious to secure is assistance in testing out these seedlings?—That is all.

A.726. Not in their production?—No.

A.727. In the work in which you are engaged are not many thick seedlings thrown out by chance, although you make crosses for thin seedlings?—Generally not.

A.728. Not many?—In fact none at all. I have such experience now for about 12 years and I have found none at all. If I want thick cane I have to choose a different class of parents.

A.729. It is surprising that with such a very large number of seedlings some of them should not have developed the thick character?—It is because none of the parents used were thick.

A.730. Your present limitations are really limitations of time? That is a most serious limitation?—Yes, chiefly time. Now we have got a fairly sufficient amount of land.

A.731. And the methods you are familiar with, at any time you could work upon a different series of types?—Yes.

A.732. At any time you could produce canes of almost any description?—That is what I think. I am very optimistic about it.

A.733. It is all a question of time?—Yes.

A.734. You informed us that you were the only one trained officer. Would it not be advisable to have two. Something like a life-insurance?

A.735. Do you generally provide for two or three?—I have got at least four people who could do breeding all right.

A.736. That is my point. I understood that there was only one assistant who was doing breeding work?—No. The whole staff can do it.

A.737. *Dr. Hyder*: I want to know whether you have made any original contributions to the study of canes or cane breeding or you are simply carrying on the work in which you were initiated by *Dr. Barber*?—I have made material contributions on the breeding side of sugarcane and this has been duly recognised by the leading sugarcane journals of the world. In fact I could show you one or two cases where they have editorially reviewed my work with very great favour. Carrying on the work at the station is not like the carrying of a substance from one place to another. It is something like bringing up a growing child, problems develop as growth progresses. The child develops indigestion and kicks about and various devices have to be contrived by the person in whose charge it is. If I may say so, from the very beginning my contributions towards the breeding of sugarcanes have been material and my master *Dr. Barber* has himself handsomely acknowledged my work in some of his first publications.

A.738. Your works have appeared in print?—A number of them.

R. S. T. S. Venkatraman.

A.739. Have your canes been tried outside India?—Yes. There is one instance, which I quote, of a report from Cuba. My canes are now going almost everywhere. I am told that even Java has got them now.

A.740. Regarding the question of import duty, could you tell me what the real cost of production per maund is apart from the cost which is given in statements submitted to the legislature or to a committee?—I happen to know that in Bihar the cost of production per maund of cane, this is based strictly on information given to me, was in one instance hardly three annas, that is, the cost of production on the plantation. It compares very favourably with the cost of production in other countries of the world. It may be observed here, that, in the main cane tracts of India, the climatic conditions are such that we can grow cane very cheaply. In the United Provinces there is sometimes no need for irrigation. Bihar has such a rich, deep soil that we are able to get a very good crop indeed. It is my considered opinion that in India we should be able to produce cane at a much cheaper rate per maund than in the other sugar countries of the world.

A.741. So much for the people. What about the manufacturers and business men? They might perhaps have an import duty. You are of that opinion?—Yes.

A.742. *Sir Ganga Ram*: You use 120 inches of water. If your water were reduced would your yield be comparatively reduced?—I will just explain. This 120 inches of water was the average for the whole farm. But I have got varieties which could grow in 70, 50 and 40 inches. In fact I have got a cane in the Punjab which grows without any irrigation. It is a cane which has a deep rooting system and it produces sugar without irrigation.

(The witness withdrew).

The Commission then adjourned till 10 A.M. on Friday, the 19th November, 1926, at Madras. For evidence taken at Madras from 19th to 25th November, 1926, except that of Lt-Col. R. McCarrison (Imperial) which follows, see Volume III.

Thursday, November 25th, 1926

MADRAS.

PRESENT:

The MARQUESS OF LINLITHGOW, D.L. (*Chairman*).

Sir HENRY STAVELEY LAWRENCE,
K.C.S.I., I.C.S.

Sir THOMAS MIDDLETON, K.B.E.,
C.B.

Rai Bahadur Sir GANGA RAM, Kt.,
C.I.E., M.V.O.

Sir JAMES MACKENNA, Kt., C.I.E.,
I.C.S.

Mr. H. CALVERT, C.I.E., I.C.S.

Raja Sri KRISHNA CHANDRA
GAJAPATI NARAYANA DEO of
Parlakimedi.

Professor N. GANGULEE.

Dr. L. K. HYDER.

Mr. B. S. KAMAT.

Dewan Bahadur T. RAGHAVAYYA PANTULU
GARU.

Rao Bahadur B. MUNISWAMI NAYUDU
GARU.

} (*Co-opted Members.*)

Mr. J. A. MADAN, I.C.S.

Mr. F. W. H. SMITH.

} (*Joint Secretaries.*)

Lieut.-Colonel R. McCARRISON, C.I.E., M.D., D.Sc., LL.D., F.R.C.P.,
I.M.S. (in charge of the Deficiency Diseases Inquiry, Indian
Research Fund Association, Pasteur Institute, Coonoor,
S. India).

**Memorandum on Malnutrition as a cause of physical inefficiency and ill-health
among the masses in India.**

The object of this memorandum is to indicate (a) the great importance of malnutrition as a cause of physical inefficiency and ill-health among the masses in India; (b) the intimate connection which exists between problems of nutrition and those of agriculture; and (c) the necessity for the closer co-ordination of nutritional, medical, veterinary and agricultural research in this country.

1. Of all the disabilities from which the masses in India suffer malnutrition is, perhaps, the chief. The more spectacular, endemic and epidemic diseases, such as cholera, malaria, dysentery, tuberculosis and leprosy, kill their thousands yearly; but malnutrition maims its millions, and is the means whereby the soil of the human body is made ready for the rank growth of the pathogenic agents of many of those diseases which afflict the Indian people. It has, for example, been shown by researches carried out under the auspices of the Indian Research Fund Association, that dysentery—a common scourge of India—can be produced under experimental conditions in animals, closely related to man, merely by feeding them on food deficient in certain substances (vitamins) upon which

normal metabolism is dependent. It was found that while well-fed animals might harbour the *entamoeba histolytica*, which is the cause of dysentery, they did not develop this malady although living in the same room and subject to the same risks of infection as ill-fed animals which, being carriers of this organism at the time the experiment commenced, developed dysentery in consequence of the lack of resistance to it brought about by the defective food. Similarly, it has been shown that hog-cholera and other infections can be caused to overrun the animal organism by the same means. These observations have now been confirmed and extended in other countries; and quite recently it has been found that the susceptibility to tuberculosis, typhoid fever and pneumonia—all of which are very prevalent in India—is greatly enhanced by the use of food of low biological value which contains an inadequate supply of vitamin A. Investigations of this kind have made it possible to enunciate the rule that many pathogenic agents of disease are capable of exercising their harmful effects only when the human or animal body is debilitated by various means of which imperfect nutrition is the chief. It follows, therefore, that a primary essential in the prevention of such diseases is the adequate nourishment of the human and animal organism. A number of other diseases of a metabolic nature are likewise the result of improper food. Of these it is only necessary to mention scurvy, rickets, beriberi, certain eye diseases and stone in the bladder, all of which exact an enormous toll in this country.

The effect of imperfect food in causing a degree of physical inefficiency, which may not be associated with any gross evidence of disease, is exemplified in India as in few other countries in the world. Few who have travelled far in India can have failed to observe the remarkable difference in physical efficiency of different Indian races; and although there are a number of factors, climatic and other, which play their part in determining these differences, yet it has been shown by researches carried out in this laboratory, and by Colonel McCay in Calcutta, that nutrition is the chief among them. The differences in physical efficiency of different races in India have been definitely correlated with differences in the biological value of foods which necessity, habit, or religious prejudice has forced them to use.

Malnutrition is thus the most far-reaching of the causes of disease in India. It is one of the greatest—if not *the* greatest—problems with which the investigator of disease is faced. It is, too, the chief among the problems facing those engaged in agricultural research. The ultimate aim of both is the same: the adequate nutrition of the people. So far, then, from agricultural and nutritional research being carried out in isolated compartments, there should be the closest co-operation between them, to the mutual advantage of each and to the widening of scientific vision.

2. It is not alone in regard to the human subject that malnutrition exerts such harmful effects. Man's domestic animals suffer no less than he himself. It suffices in this connection to refer to the effect on cattle of pasturage which is deficient in certain mineral ingredients. As an example of this kind the now well-known effect of deficiency of phosphorus in the soil, and, therefore, in the vegetation, on the health of cattle and sheep may be mentioned. Such deficiencies exist in large tracts throughout India as, for instance, in the soils of Bihar. In India, unfortunately, millions of stock exist in a state of semi-starvation. As draught animals they are consequently inefficient; and as producers of milk and milk products—so essential as food for mankind—they are more inefficient still.

There is, perhaps, no more important department of agricultural and nutritional research than that which deals with animal husbandry; and here I should like to emphasise that the problems of animal husbandry are also the problems of human husbandry.

3. Human and animal inefficiency is reflected in the soil; in its imperfect cultivation; in inadequate manuring; and in crops scanty as to quantity and deficient as to quality. Too few animals are kept by the cultivator, as the scanty vegetation cannot support them; and so there is

returned to the land too little of that organic matter, in the form of farm-yard manure, on which the continued fertility of the soil is so dependent. It has been shown in regard to plants, as in regard to animals, that they cannot thrive, nor their seed attain to the fullest "reproductive quality", unless they be provided, in addition to the mineral constituents of their food, with certain organic substances known as "auximones". These substances, which are akin to vitamins, are as essential to the normal metabolism of plants as vitamins are to the normal metabolism of man and animals. They not only enable the plant to build up from the simple ingredients derived from the soil those organic complexes required as food by men and animals, but they enable it to elaborate vitamins without which these organic complexes cannot be properly utilised by the animal organism. Auximones are produced in the soil from decaying organic matter by the action of certain soil bacteria; and the best organic matter for this purpose is farm-yard manure. So it is that such disabilities of mankind as are due to faulty nutrition are sometimes traceable to the soil itself, which has become exhausted and unproductive of the best kind of food through improper attention and cultivation. Malnutrition, thus, pursues its harmful course in an ever-widening vicious circle; the cultivator is too often ill-nourished and ravaged by disease which is commonly the result of his ill-nourishment; his beasts are alike ill-nourished; while both toil wearily in a heartless effort to extract from the ill-nourished earth enough to keep them from starvation. The solution of the problem of malnutrition is thus, to a great extent, one of improvement in methods of agriculture.

4. Considerations of this kind led me, in the course of the inquiry on which I am engaged, to attempt, in a way as wide as my limited circumstances permitted, a study of the soil conditions which influence the nutritive value of the commoner food grains of India. Millions of people in this country rely from generation to generation on a single cereal as the main staple of their dietary. It seemed necessary, therefore, to be aware not only of those soil conditions which influence the yield of grains but of those which influence their nutritional quality. This attempt was made not only because it was the logical outcome of the work on which I was engaged—an inquiry into the effect of faulty food on the causation of disease in general—but also with the object of widening the scope of nutritional investigations and of linking them up with agricultural research to which they are so closely allied. The soil conditions which it was thought would be likely to influence the nutritive quality of food grains were (a) the chemical composition of the soil itself; (b) the manurial treatment to which it is subjected; and (c) irrigation as compared with normal rainfall. So far my investigations have not proceeded beyond the experimental study of the effect of certain manures on the nutritive value of millet and wheat. They are, unfortunately, very tedious and the output of work is limited by the limitations of a single investigator. The results already arrived at are, however, of interest. It has been found in regard to millet—a common food grain in South India—that soil on which it is repeatedly grown, but which has received no manure for many years, yields a grain the nutritive value of which is so low that it may actually be harmful to the users of it; suggesting the acquirement by the grain of toxic qualities. It has been shown, moreover, that the nutritive and vitamin values of the millet grown on soil treated with cattle or farm-yard manure are markedly superior to those of millet grown on the same soil when treated with a complete chemical manure. In regard to wheat it has been found that when it is grown on soil treated with farm-yard manure, its nutritive value is approximately 17 per cent. higher than when grown on soil treated with complete chemical manure. The deficiencies of the wheat grown under the latter conditions are due in the main to an inferior content of vitamin A, that substance which is so essential in maintaining the resistance of man and his domestic animals to infectious diseases. In this work—which I venture to think provides an example of the advantages to be derived from collaboration between investigators of nutritional and agricultural problems—I have had the active assistance of the Department of Agriculture, Government of

Madras, and of the Agricultural Chemists on the staff of the Agricultural College, Coimbatore, without which it would have been impossible to carry it out.

5. Questions of irrigation—the means to be adopted to prevent the slow but sure deterioration of soil which is constantly being irrigated, and the consequent deterioration of the crops grown upon it—are alike of interest to students of nutrition and public health and to those engaged in agricultural research. The possible bearing of these questions on the tendency towards intense malaria when dry crops are grown under canal irrigation is one of the most important of the public health problems awaiting solution. It has been referred to in detail in Mr. Albert Howard's Presidential Address before the Indian Science Congress at Bombay early in the present year: an address which brought into prominence certain aspects of agriculture and their relation to disease which are of the utmost importance to this country.

6. Among the manifold needs of India at the present time not the least urgent are these:—

- (a) The wise extension of research on nutrition—plant nutrition, animal nutrition and human nutrition—under broad-minded direction. These are not different subjects but the same subject: a continued story following a natural and ordered sequence from its beginning with the soil, through vegetable and animal life, to its final stage in the man himself. In the telling of this story India should be encouraged to play an adequate part. My experience of Indian assistants has taught me that nutritional research is of a kind which appeals to the Indian possessed of the necessary scientific education. For my own part, I would desire to see many such young Indians trained in its prosecution and engaged upon it under proper direction.
- (b) A second need is the co-ordination of all the forms of research—nutritional, medical, veterinary and agricultural—which have for their aim the betterment of the health and physical efficiency of the people of India. It is essential that those who are engaged in agricultural research should be aware of its bearings on public health or *vice versa*. At the present time much effort is dissipated for want of such co-operation between research workers. The matter is, however, beset with many difficulties. I mention it merely to indicate its importance.

It is, I believe, only by the extension of research along broad lines, by its proper co-ordination, and by the employment of the best brains which India can herself provide, that this country will obtain the highest return for money expended upon research.

Oral Evidence.

A.743. *The Chairman:* Colonel McCarrison, you are a Member of the Indian Medical Service and you are in charge of the Deficiency Diseases Inquiry, which is under the Indian Research Fund Association, at the Pasteur Institute, Coonoor?—Yes.

A.744. Sometime ago you provided the Commission with a note giving an outline of the work on which you are engaged; since then my colleagues and I have had an opportunity of visiting your Institute at Coonoor, of seeing your work and of having the advantage of an explanation by yourself of what you are doing there; but we were anxious to get some facts connected with your work and some of your views and so we have asked you to come here to-day. I understand from what you have already told us that it is your view that the Institute over which you preside at Coonoor, the Agricultural Research Station at Coimbatore and the Animal Nutrition Section at Bangalore, from the fact of their relative contiguity, offer a great opportunity for the extension of your work in this Presidency?—That is my opinion. One point is that I am not in charge of the Pasteur Institute at Coonoor; I am a guest there; I have my laboratories there. But I feel that Madras is very fortunately situated for research work on nutrition in all its branches, human, animal and vegetable, because of the nearness of Coonoor, Coimbatore and Bangalore to each other.

A.745. I take it that it is your view that the general problems of malnutrition in man and beast bear very closely on the terms of reference of this Commission?—Yes, I think so.

A.746. I shall ask you to describe some of your work in a moment or two; what other work of this nature is being carried out in India at this moment?—As far as I am aware there is no work being carried out in India on nutrition at the present time except what I am doing.

A.747. So that, so far as nutrition in man goes, you are the only officer engaged on research on an absolutely vital problem affecting the welfare of 300 million people?—Yes.

A.748. Are you carrying on the work as a successor of someone else, or did you create this work yourself?—I created it.

A.749. Have you any successor in view?—I know of none.

A.750. If you went to-morrow, would your work be carried on?—There would be no one, so far as I am aware, who could carry on, who has devoted his life to the study of nutrition as I have done.

A.751. How many years have you been engaged in this work?—My work in connection with nutrition itself I started in 1913, just before the War; it was interrupted by three years' active service; then I came back to it again; it was interrupted again owing to financial retrenchment and it has been finally re-established 15 or 16 months ago. Every time I have gone the work has come to an end and has had to be started afresh, even to the making of my animal cages and so on. Right from bed-rock I have had to start afresh every time. Personally I think that is a great pity. I feel that this work on nutrition is of such vital importance to the people of this country that it ought to be put on a permanent basis.

A.752. What basis do you suggest?—I suggest that there ought to be established at once or as soon as possible an institute of nutrition which would deal with problems of nutrition in human beings, animals and plants, because nutrition is not a matter which refers only to the human being; nutrition refers to men, animals and plants.

A.753. Would you suggest that such an institute should be under the Government of India or under the Government of some Presidency or Province?—There is room for such an institute in every Presidency in this country. There is room for another one under the Government of India. My experience is limited to this Presidency, and as I said, this Presidency is particularly suited for the work.

Lieut.-Col. R. McCarrison.

A.754. I suppose your own feelings are that you are not very much concerned how continuity is attained provided it is attained?—That is so. My business is to do the work; it is the business of others to see it is continued.

A.755. You have no firm views as to whether your own particular institute, if it could be connected up with Coimbatore so far as plant nutrition goes and with Bangalore for animal nutrition, should be under the Provincial Government or the Government of India?—No, I am not concerned with that.

A.756. Have you sufficient space at Coonoor to extend?—No, I have not. I have got three laboratories there; that is all that is available there at the moment for work in connection with nutrition.

A.757. Have you the land upon which further buildings could be erected?—There is a good deal of land, I understand, connected with the Pasteur Institute at Coonoor, if it is decided to make that a centre of nutrition work, where buildings could be erected if they were necessary.

A.758. Is it your view that Coonoor is an appropriate place in which to carry on this work?—I think it is an ideal place.

A.759. Are there any buildings in the immediate neighbourhood of the building at present occupied by your animals and so forth, which might usefully be leased or bought?—There is a vacant jam factory which is next to the Pasteur Institute; the grounds of the two institutions are side by side; the buildings are eminently suited for nutritional work, but I understand it is the intention to apply them to some other purpose, with the details of which I am not familiar.

A.760. Official or non-official?—I only know this unofficially.

A.761. The use of the buildings is to be non-official?—No; official.

A.762. Now I think I may leave you to give the Commission an outline of your work; I think it must be an outline only, because plainly we are not as a body concerned with the detailed scientific aspect of the work which you are doing at Coonoor, and I hope you will bring out if possible the direction in which man and beast inhabiting these areas are suffering from malnutrition, and if possible indicate to the Commission the sort of direction in which within the economic capacity of the individuals who are suffering from malnutrition some steps to remedy the situation might be adopted?—By "malnutrition" I mean the impairment of the normal physiological processes of the body consequent on the use of a food which is deficient in quality although it may be abundant in quantity. The remarks which I have to make do not therefore deal with the problem of starvation or of semi-starvation which I recognise as being also an important cause of malnutrition; I am dealing solely with the quality of the foods in common use in this country and with their capacity thoroughly to satisfy the functions of food. The functions of food are four-fold,

- (1) to repair tissue waste,
- (2) to supply energy,
- (3) to maintain the normal medium in which the bio-chemical processes of the body can take place, and finally,
- (4) to make these processes possible.

My work has been chiefly concerned with the last of these, that is to say, with vitamins: substances the function of which may be compared to that of the spark which ignites the fuel mixture of a petrol engine liberating its energy. The spark is of no use without the fuel, nor the fuel without the spark. I would like now to show you what are the effects on animals which receive an adequate diet consisting of proteins, fats, carbo-hydrates, salts and water in proper proportions but which is lifeless owing to the want of these substances, vitamins. This chart (marked "A")* shows that if rats be fed on a diet containing everything they require, proteins, fats, carbo-hydrates and salts, but without vitamins, they will not grow and after a very short time they become paralysed. These are paralysed rats which have

* Figures and Charts follow after page 116. Chart "A" has not been reproduced.

been fed on an otherwise adequate food which contained no vitamins. The same results follow in pigeons, men, monkeys and other animals. One of the chief foods in use in India and in this Presidency especially is rice. I should like to show you that rice is a fundamentally poor diet; it is a diet which in itself will not support the human body in its fullest efficiency, although the people who are using rice may be eating it in large quantity. In this chart (marked "B") the lower curve relates to a group of animals which have been fed on an otherwise complete diet containing no vitamins. To this diet I added one gram of rice so as to provide the necessary spark, the vitamins. The next curve indicates the rate of growth under those conditions. If instead of adding one gram of rice I add one gram of wheat the difference is enormous. Rice is therefore a fundamentally poor diet. I next tried to ascertain why it is that rice is so poor; so I added vitamin A to it. The next curve indicates the rate of growth. I then added vitamin B, and the next curve shows the rate of growth. Yet I was unable to make it equal to that given by one gram of wheat, the reason being that rice contains a protein of poor biological value and is also very deficient in certain substances such as manganese which is very important for growth. Here is the chart (marked "C") of which I have shown the original photograph. If now I take a diet which is complete in every regard, proteins, fats, carbo-hydrates, salts and vitamins, and add to it a slight trace of manganese, as much manganese as there is in wheat, wheat being particularly rich in it, you will see I make good to a great extent the deficiency of rice; that is to say, I have got to add vitamins A and B and manganese before I make rice equal to wheat in nutritional value. This is exemplified in another way; here is a chart (marked "D") which represents the difference in nutritional values of certain grains in common use in India. This one is wheat; these curves represent *cholam* and *cumbu*, two grains in common use in this Presidency, this one represents paddy. The two rats at the bottom represent the difference between a wheat rat and a paddy rat. When the Commission did me the honour of visiting my laboratory, they saw there an experiment dealing with the relative values of the national diets of India tested biologically on groups of animals of the same original weight. These diets are representative of different peoples, Sikhs, Mahrattas, Pathans, Gurkhas, Kanarese, Bengalese and Madrasis. You will see on this chart (marked "E") that the diet of the wheat-eating people of the north who also take a great deal of milk, butter and *ghi*, far surpasses in value that of the rice-eating people of the south. The upper chart shows the distribution of leprosy in this country. You will notice that the greatest prevalence of leprosy is amongst the people who use the poorest food while the least prevalence of leprosy is amongst the people who use the best food.

I have chosen leprosy to represent and emphasise this particular point, but it is not only with regard to leprosy that this is true; it is true with regard to other diseases. For example, the death-rate from cholera in Madras is 40 times greater than it is in the Punjab. Chief amongst the diseases which these deficiencies in diet cause are diseases of the gastro-intestinal tract. I see from the report of the Surgeon-General with the Government of Madras for last year that there were no less than 9,500,000 attendances at the hospitals and dispensaries of this Presidency. In the course of my work, I have produced in animals acute gastro-intestinal diseases like diarrhoea, dysentery and so on, and chronic gastro-intestinal diseases like dyspepsia, dilatation of the stomach and colitis. Of these 9,500,000 attendances at the hospitals and dispensaries of this Presidency, I calculate that no less than 3 millions are ill-nourished, and are suffering from diseases which are directly or indirectly due to malnutrition. In this chart (marked "F")* you will see what the effect of a perfectly good diet is on the gastro-intestinal tract of a monkey when that diet has been killed by auto-claving in a temperature of 130° C. for an hour and a half, which has had the effect of destroying the vitamins. This is the gastro-intestinal tract of a healthy monkey which was living in the jungles of Madras 3 or 4 days before I put it under experiment. The lower chart shows what the effects of the devitaminised diet are.

* Not reproduced.

There is great dilatation of the stomach, the colon is converted into an inert bag, causing chronic constipation and all the evils which result therefrom. It is not only with regard to food deficiencies that this work of mine deals, but also with regard to diseases arising from poisons contained in the food grains. You will see here a picture (marked "G")* of three: a man and two boys. The man is of magnificent physique, from Hunza, where lives probably one of the finest races of mankind. He and many others were transferred in my time as Agency Surgeon at Gilgit to a new tract of land, where the wheat grown was of very poor quality and therefore they had to grow a vetch called *lathyrus sativus* with the result that they suffered from Lathyrism, which causes a kind of paralysis, and has paralysed these subjects from waist downwards. Nutritional work does not deal only with deficiencies in food. Here is another chart (marked "H"), which illustrates the difference between a Sikh diet, illustrated by the upper curve, and a diet which is in common use among the poorer Europeans, both in this country and at Home. I took two groups of animals of the same initial weight and one of them I put on a diet consisting of milk, green vegetables, butter, fruits, whole wheat bread and occasionally meat; you will see that they did very well, whereas the animals that were fed on the poorer European diet did very badly. That diet consisted of white flour (white bread), tea, sugar, margarine, jam, potted meat and boiled vegetables. The potted meat and margarine contained such preservatives which are now in common use, namely boracic acid, sulphurous acid and formal-dehyde. I wish to emphasise that the second group of animals died from two causes, gastro-intestinal diseases and lung diseases. Lung diseases are among the most common diseases in this country. You will see in this chart what you might call for the purposes of explanation the Sikh rat and the poor European rat. Not only does the poor European diet give rise to these conditions, but it also produces new growths in the stomach, which I am investigating at the moment, and which may be, although I am not prepared to say so at present, the beginnings of cancer. You can see what the appearances of the two groups are in this picture.

The next picture to which I would like to refer shows the effect of white flour, which is nowadays being so commonly used not only outside this country but also in this country. These animals were fed on the usual diet which contains everything except vitamins. One group was given 1 gramme of white flour, the other 1 gramme of whole wheat flour (*atta*) to supply the vitamins. You will see that the former did not grow, whereas the rats which were given 1 gramme of whole wheat did grow, but in the former case immediately I added the vitamin, they grew so quickly that they overlook the others. I show here one of the animals that were getting the wheat, one of the animals that were getting white flour, and a paralysed animal that was getting the basal diet only. At this point I added vitamins and you see from the chart (marked "H2") how rapid the growth was. In connection with the susceptibility of mankind, when they are so fed, to disease, I should like to emphasise in this chart that men living at this level have but a short race to run before death overtakes them, if they be infected by something like cholera or dysentery, whereas if better fed, they have a much better chance of escaping death. The next illustration (marked "I")* contains life-size pictures of stone in the bladder, which I have produced in animals by feeding them on a faulty diet. I wish to remark that this is one of the diseases in this country which is so prevalent and which causes an immense amount of distress; I have succeeded in producing it in animals, and therefore I hope to succeed in doing away with it in man if people are only able to feed themselves properly. I have already drawn your attention to the fundamental poverty of rice as a food. In addition to this poverty of the grain as it comes from the field, it is subjected to all sorts of milling and polishing processes. This chart (marked "J1") represents groups of animals fed on the same rice which was specially grown for me by the Agricultural Department of the Government of Madras; and which has been subjected to the various milling processes. The first curve shows the effect of a diet of the original paddy; it does no more than just support the animal at main-

* Not reproduced.

tenance level. When the rice is par-boiled, it just fails to support them at maintenance level. In connection with this failure to support them at maintenance level, it fails to keep them in health; one of the chief complaints from which they suffer is eye disease. In this Presidency alone there were no less than 885,000 people attendances at the hospitals and dispensaries for eye diseases; that is to say 1 in every 50 of the whole population.

A.763. *Professor Gangulee*: That is due to the deficiency of vitamin A?—A great part of it is due to the deficiency of vitamin A. When you proceed to polish the rice, you greatly reduce its food value, until you get the highly polished rice which is so widely in use, and is quite incapable of supporting life; and unless it is supplemented by other articles of diet, health cannot be maintained.

A.764. *Sir Ganga Ram*: Polished rice is rather a luxury for European countries, is it not?—Yes, it is, but I do not think European countries are as yet very much wiser with regard to food than we in the East. This chart will illustrate to you how the disease of beriberi occurs in this Presidency. Beriberi is a disease which is peculiarly the property of the Madras Presidency; it occurs on the East Coast of Madras, and practically nowhere else in India. You see in this chart (marked "J2") the food value of rice subjected to high polishing. No man lives by rice alone; he has to take gram or dal or something of the kind; in this Presidency the people usually take something like 2 to 4 ounces of dal.

A.765. *Dr. Hyder*: What kind of dal?—I am not sure, but I think it is *tur dal*. Animals fed on a diet which has the nutritive value of the highly polished rice will not develop beriberi. Beriberi is due to the insufficiency in the diet of a substance called vitamin B; it is only when the insufficiency reaches a particular point that beriberi occurs. Paradoxical as it may seem, a little vitamin B is necessary for the production of beriberi.

A.766. *The Chairman*: Otherwise the man dies of starvation before he gets beriberi?—Yes, he dies of a specific form of starvation. This is a chart (marked "L") which illustrates the relative values of various rices in use in India; they vary tremendously. Here is another chart (marked "M")* which introduces another phase of the subject, that is to say deficiency of certain mineral elements. Deficiency of iodine is an important cause of a certain form of goitre and of its sequelæ, namely, cretinism and hairless disease which is common in certain animals, for instance, hogs and goats. I do not know whether hairless disease occurs in India or not. I have been able to produce cretinism and hairless disease experimentally in animals. In the middle chart, we have an example of another influence of vitamin deficiencies, that is to say, great susceptibility of both man and beast to infection in consequence of those deficiencies. In this particular instance the disease produced was Epithelioma Contagiosum, which is a disease that affects fowls and other birds. As I see the Commission is desirous of ascertaining the extent to which the keeping of fowls could be introduced in this country, I would like to point out that one of the diseases from which they are liable to suffer is Epithelioma Contagiosum and they will suffer from it unless they are properly fed. Here is a chart (marked "N") which illustrates the complete eradication of goitre from a school in consequence of the researches that have been carried out in my laboratory. The next chart (marked "O")* shows the effects on the gastro-intestinal tract of faulty food deficient in vitamins. The cross-section of the large bowel is shown here, and you will also see a representation of the normal large bowel, which is provided with a very intricate neuro-muscular mechanism. The specific effect of deficiency of vitamin B is to interfere with this mechanism so that the gut becomes converted into an inert bag which cannot empty itself and becomes subject to disease in consequence. In this chart you will be able to see the differences between the healthy and the diseased colon. Great atrophy has taken in the latter place.

A.767. *Sir Ganga Ram*: Has food anything to do with the increase of tuberculosis?—Dr. Muthu of this Presidency is the great authority on tuber-

* Not reproduced.

culosis in India, and he is convinced, after having spent a lifetime working in it, that a contributory cause of tuberculosis in this and other Presidencies in India is malnutrition.

A.768. Is impure air a factor?—This factor comes in; I do not wish to be understood to say that food is the cause of every disease, but faulty food deficient in the vitamins is the foundation on which many diseases are built. Its chief effect is to cause depreciation of cellular function throughout the body; and depreciation of cellular function makes it possible for pathogenic organisms to grow in the body; no pathogenic organism will flourish on healthy vigorous tissue. I want to emphasise strongly that there is no single factor so important to the well-being of any people as a well-balanced, nutritious diet.

I now refer to the chart marked "P." As an outcome of this work, we must, of necessity, come back to the soil. So, in the course of these investigations, I found, for example, that rice grown on the East Coast of Madras and the same rice grown on the West Coast of Madras differed in nutritive quality. I then tried to find out what the cause of that was. I thought it might be due to differences in the soil and one of the first things we investigated in collaboration with the Agricultural Department of this Presidency was the effect of manurial conditions on the nutritive value of wheat. I will give you an example. On this chart one curve represents our basal diet containing no vitamins; the next curve represents the basal diet containing vitamin A; the next curve represents the basal diet containing all vitamins; and the last two curves represent the basal diet *plus* one gramme of wheat which has been grown on soil manured with cattle or chemical manure. One gramme of wheat grown on soil manured with cattle manure gave a rate of growth which is approximately 17 per cent better than that of wheat grown on the same soil with artificial mineral manures. But the point I should like to stress here is this: that whole wheat, however poor it may be, is a magnificent food; it is better than cod-liver oil and marmite put together. Before I leave this subject, I should say that subsequent experiment revealed that the reason why cattle manure wheat is better than chemical manure wheat is because of a deficiency of vitamins in the latter. This chart (marked "Q") relates to experiments of a similar kind with millet. But the experiments were of a different order. I took first of all a diet of polished rice such as that dealt with on a previous chart. I fed groups of pigeons on this polished rice. Then by adding millets from various sources, I saw to what extent these millets were capable of preventing the animals declining in weight. Here again we find that millet grown on cattle manured soil has a greater capacity for preventing loss of weight than that grown on chemical manured soil. The curious thing in this experiment was that millet grown on soil which had received no manure at all for a long time was actually harmful. The last piece of work which I have been attempting to do, and which is as yet incomplete, I show you mainly to illustrate the extraordinary width of range that this work on nutrition has. This chart (marked "R") illustrates the results so far of an enquiry into the effect of various kinds of irrigation on the nutritive value of wheat. At present the experiments are incomplete, but there is one point to which I might refer. It has been suggested that continued old canal irrigation reduces the nutritive value of wheat. This experiment has been going on for 75 days and there is no proof that old canal irrigation does influence the nutritive quality of wheat; but the experiments are incomplete and I am not yet prepared to give an opinion with regard to it. That is a very brief outline of the kind of work we are doing at Coonoor.

A.769. *Professor Gangulee*: What about paddy? The irrigation in this Presidency is mostly on paddy?—That I do not know yet; this work has only just begun.

A.770. *The Chairman*: Colonel McCarrison, we are greatly obliged to you for the very interesting account of your work which you have given us. I think we must resist the temptation to pursue you into the thickets of physiological disputation, but I think my colleagues would like to ask you

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one or two questions based on our terms of reference?—If I may say so, when you did the honour of visiting me at Coonoor, you also asked me whether I would also say something to the Commission on the effect of malnutrition on animals. I am perfectly prepared to do so, should you wish it.

A.771. I think we should like to hear that now?—I can do that very quickly. In these observations I am now going to make, I am not dealing with the effects of an insufficiency of food on cattle; I am dealing solely with the effects of a faulty food, a food which is in itself incapable of fulfilling the functions of food, on animals which do not receive, for example, a sufficiency of minerals in the food. So far, research on stock has been carried out mainly from the point of view of deficiency of mineral elements, while research on man has been mainly carried out from the point of view of deficiency of vitamins. It is a most excellent thing that it should be so, because the result has been that one branch of nutritional research has gone along one path while another branch has gone along another path; and those two paths must eventually meet; it is absolutely necessary that they should converge and go along the same road. Therefore, there is very much that those engaged in nutrition research on animal nutrition can learn from us and very much that we can learn from them. The chief effects on animals so far studied are those due to deficiency of certain mineral constituents in natural pasturage. Animals become poor, small sized, and low milk-yielding in the case of cattle. I showed in the year 1918 that the milk which the cattle produce and the butter which we get from the milk are, in consequence of the poverty and dryness of the fodder, lacking in one of the vitamins, vitamin A. The general effects of deficiency disease in stock animals so far elicited are these: A slow rate of growth in young animals which is due chiefly to a deficiency of calcium and phosphorus. I understand that there are these deficiencies in the soils of Bihar and the West Coast of Malabar, though I know of very little work that has been done on this subject in India. Secondly, the animals are slow to attain maturity. Thirdly, there is a marked tendency for stock to decrease in size; the stock tends to remain at a size which is proportionate to the food available, just as has happened with regard to children in Russia. Fourthly, there is a high mortality, which is due no doubt to increased susceptibility to infection. Fifthly, the milk-yield is low in cows and the quality, that is to say, its vitamin value, is also low. The birth-rate tends to be low; sterility is fairly high. The carrying capacity of cows is reduced, they have poor coats, and they suffer from skin diseases. There is an abnormal craving (*pica*, as it is called) for various things such as bones, a condition which is known as osteophagia. They also eat earth, mud and very often in this country they eat things that are worse than mud. They have a great craving for salt and salt licks. I am not sure whether it is so, but I am told that some of the goat herdsmen in certain parts of India actually take their herds in the morning round the village to play the part of scavengers. I would now like to refer to the effects of specific deficiencies. One of the first of these is want of iron. That gives rise in pigs to a disease which is called McGowan's disease. It is not necessary to go into the symptomatology of this disease. Deficiency of iron also causes great emaciation and anæmia, a condition which is common in certain parts of New Zealand. Then, want of iodine also, as I have said, gives rise to goitre and hairless disease, examples of which I have shown you as having been produced in my laboratory. Want of iodine also impairs the capacity of the animal to assimilate calcium and phosphorus, and so the bones become soft. Want of phosphorus in the soil leads to osteomalacia, which is softening of the bones, poor bones, fragile bones, swelling of joints, stiffness of hind quarters and lameness, a condition which in South Africa is called *Styfsiekte*. Want of phosphorus also causes craving for bones. This craving for bones leads the animals to look for bones in decaying carcasses. In these decaying carcasses they find an organism which produces a very virulent toxin which gives rise to a disease known in South Africa as *Lamziekte*. That disease is due to the products of the bacteria which live in the decaying bones; the

bacterial toxins are the actual cause of the disease. It is the want of phosphorus that causes the animals to eat these bones. Another cause of disease in cattle is want of salt, chlorine and carbonates. This is a summary of most of what is known at the present time as to the effects of malnutrition in the causation of disease in animals; no doubt there is much more to be discovered if we look for it.

A.772. *Sir Ganga Ram*: What disease would you expect to arise merely from want of salt?—I should expect emaciation and slowness of growth.

A.773. In milk animals does it decrease the quantity of milk?—Now you are asking me of matters of which I have no personal experience, but from the knowledge I have of experimental work I should say it would lower the capacity of the animal to produce milk. In addition to these diseases, there are others which are the result of infection by micro-organisms consequent upon a state of malnutrition. One of these is called Sarcosporidia or scrapie in sheep. Another condition which is common in sheep and goats is pernicious anæmia, a condition which I have succeeded in producing in the laboratory. Finally, there is the condition, which I have also produced, of hog cholera. These are some of the diseases which are known to prevail in other countries consequent on malnutrition; that is to say, consequent on the consumption of a food which is of poor quality. I do not know to what extent they prevail in this country, but I have given you the list so as to emphasise the very great importance of research on animal nutrition. It is necessary to ascertain to what extent these diseases do prevail in this country.

A.774. *Sir Henry Lawrence*: Is nutrition work on similar lines being conducted in institutions in Europe?—Yes, very largely.

A.775. Where?—Well, of course Cambridge is the centre of it. Sir Gowland Hopkins is the father of modern nutrition, and his work is being carried on there with great vigour. It is also being done at the Rowett Institute in Aberdeen and at the Lister Institute in London. No doubt there are other places which escape my memory at the moment. There are at least four or five centres of nutritional work in England alone where the population is something like one-sixth of what it is in India.

A.776. *Sir Ganga Ram*: What are the journals or pamphlets in which they publish the results of their labours?—All the work done on behalf of the Indian Research Fund Association is published in the official journal of the Indian Research Fund Association.

A.777. *Mr. Kamat*: Are not the Japanese also doing this kind of research?—Yes, they are.

A.778. *Sir Henry Lawrence*: And in the United States?—Very much.

A.779. The Rockefeller Institute has taken it up?—The Rockefeller Institute has not done so much as McCollum at the Johns Hopkins Institute. When I was in America I was greatly impressed by the work that was being done, especially at the Johns Hopkins Institute. McCollum is of course one of the chief names in connection with this work; his book on the subject is one of the standard works.

A.780. And in regard to nutrition work on animals are there similar institutions? There is one just being started in Edinburgh, I think?—Yes; and there is one which has been going in Aberdeen for some years, which has been doing good work.

A.781. Do they carry on experiments on rats and other animals?—Most of the work on human nutrition is done on rats because the rat is an omnivorous animal, and the life of the rat being short one is able to study it from the day of its birth to the day of its death, a comparatively short period of time. If we had to use larger animals, such as monkeys, it would be impossible to get the work done in a reasonable time. All that has been found out with regard to rats has been shown to be applicable to man.

A.782. It has been established that the results obtained from rats are applicable to man?—Yes. For instance, the work on rickets has been done

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on rats and dogs, and it has been directly applied to the great benefit of humanity.

A.783. In the greater part of India, is there a sufficiency of milk in the diet?—I wish to be very guarded in any answer I should give you, because my experience is mainly a laboratory one; but from what I know, I should say that there is not nearly enough milk in the diet of the people except in that of some of the better class people in the north of India. There is certainly not nearly enough milk and milk products in the diet of the Southern people.

A.784. The superior physique of certain races in the north may be connected with their having a larger provision of milk in their diet?—It is connected with it, that is my opinion. I should say it is due to the combination of whole wheat, milk and milk products.

A.785. You attach a considerable value to the item of milk?—Very great importance.

A.786. Therefore it follows that one of the greatest problems of India is to secure sufficient provision of milk in those Provinces where it is now deficient?—That is so.

A.787. You attach great importance to that?—Very great importance.

A.788. You have mentioned the case of goats being fed in the surroundings of villages. Cattle also eat excreta?—Yes, I have seen them do it.

A.789. Does that have a deleterious effect on their milk?—That I do not know from personal experience, but I should imagine it would.

A.790. It would be possible to ascertain that?—Of course, anything is possible of that sort, provided we have the means to do it, the laboratory facilities and the staff.

A.791. It would not be without a certain value, for I have known a town which depended for its sanitation on the cattle eating excreta, and it was definitely put forward by the municipal council as being the best form of sanitation that they could think of. You would not agree with that?—It is certainly one way of carrying on conservancy work, but what the effect would be on the cattle would be a very interesting thing to find out, because if they were at the same time deficiently fed they must suffer from all sorts of infections, infecting themselves from the excreta.

A.792. And that infection may be passed on to the milk?—Certainly, it might quite well be so.

A.793. It might be a very important subject for investigation?—It might, yes.

A.794. Amongst the results of malnutrition can you trace sterility?—It has been so traced in other countries and as a matter of fact the first reference to it emanated from my own laboratory. In feeding animals in this way on diets extremely deficient in vitamin B, I noticed in 1918 that atrophy of the testes was one of the earliest effects. During famines and war, sterility in women and failure of the menstrual function have been recorded as evidence of malnutrition. Which of course was half-starvation also.

A.795. From that it would follow that any section of the population who suffer from half-starvation would be deficient in reproduction?—Not necessarily so, because it depends upon the respect in which their food is deficient. For example, in order to produce that effect their diet must be deficient in a vitamin which is now being called vitamin E. Vitamin E is quite abundant in such things as wheat, paddy and other cereal grains and in green leaves, meat and fats; in fact it is in cereal grains that it is chiefly found; so that I would expect to find sterility more common in people who are subsisting, say, on white bread, than I would in people who are subsisting on a home provided paddy diet.

796. *Dr. Hyder*: Taking the case of Eskimos, I would imagine that they would not eat much cereals?—No.

A.797. And I think with them there probably is a diminution of this power?—That race is said to be dying out to a considerable extent; but there

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are many causes. One of them is infectious diseases, tuberculosis and so on. But all these vitamins are so widely distributed in nature and in flesh foods that Eskimos who would be eating blubber would probably get plenty of them.

A.798. That would be fat?—Yes.

A.799. Do you think vitamin E would be present in blubber?—I should think it would, but I have never investigated that substance.

A.800. The Eskimos live in a part of the world which is not very populous?—Their food of course is very limited in choice.

A.801. *Sir Henry Lawrence*: We were just discussing the malnutrition which appears to exist in the paddy diet. In that diet there is vitamin E?—Yes.

A.802. So you may possibly find a combination of an excessive power of generation with a serious condition of starvation?—I could not answer the question; I have not got enough information.

A.803. It might possibly result?—I should hardly say excess of power of reproducing the race; but I should say, more properly perhaps, very little impaired capacity to reproduce the race might exist with certain forms of malnutrition.

A.804. But we are finding at the present time, are we not, that there is an excessive power of generation among the C.3 population?—Apparently that is so, but I myself have not studied the subject.

A.805. Is it possible that any particular kind of diet may lead to sterility?—Yes, that is quite possible. Diets which are deficient in vitamin E, for example, will certainly lead to sterility.

A.806. It can be induced?—It can be induced in the laboratory; I can induce it myself at will; sometimes I find that my rats reproduce more quickly than I can deal with them; what I do then is simply to reduce the amount of milk and butter which they are getting and they stop breeding, or at least they do not breed so fast.

A.807. *Sir Ganga Ram*: Has the nature of food anything to do with the disparity of male and female births?—I do not know.

A.808. Have you ever studied that?—No.

A.809. The disparity is so great in different Provinces?—Yes.

A.810. In the Punjab, for instance, the percentage of male population is much more than that of female population?—I can quite see that you would be very interested in extending the study of nutrition in this country. At this meeting I am receiving many suggestions from the various Commissioners which emphasise the great importance they attach to the extension of this work.

A.811. You say there is want of calcium and phosphorus in the diet of cattle. Would gypsum be of any use?—I should have to refer you to the veterinary people for that sort of information. I have just made a summary of the diseases from which cattle suffer for your information.

A.812. Does manganese exist in any other cereal which can be eaten with rice?—Yes, it is very widely distributed in nature. If you are interested in it I can tell you where it occurs: it occurs in cabbage leaves, turnip leaves, asparagus tops, leeks, garlic, onion; fruits: orange, lemon, strawberry, while whole wheat is particularly rich in it. Wheat bran contains as much as 3.9 milligrammes per 100 grammes. Estimations in my laboratory have shown whole wheat to contain 4.82 milligrammes per 100 grammes. It also occurs in animal tissues, especially in the organs of chief functional capacity like the liver, pancreas, lymph nodes, kidney, muscles of the heart, brain and lungs. In connection with its occurrence in the pancreas, it may interest you to know that it also occurs in the active principle of the pancreas, insulin. Diabetes is an extremely common disease in this country and it is quite possible that the further study of the relation of manganese to the functional perfection of the pancreas may throw great light on the subject of diabetes.

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A.813. Can deficiency of iodine be made up by any specific vegetable?—Yes, it can be made up. It is a curious thing about these substances which exist in very small amount in foods (vitamins, manganese and iodine) that they are all found to have more or less the same distribution in plants, so that if a man eats plenty of green leafy vegetables and whole wheat, he is not likely to suffer from iodine or other deficiency.

A.814. When you say green leaves, do you mean boiled or raw?—So far as iodine is concerned, it does not matter whether they are raw or boiled. Perhaps better eaten in the raw state.

A.815. I was told that iodine occurs very largely in some herbs in the Himalayas?—There is very little iodine in the soil of certain Himalayan regions. There is a good deal of iodine in the soils of the Nilgiris.

A.816. *Sir Thomas Middleton*: You mentioned mineral deficiency in certain parts in India, Bihar and Malabar. Were these deficiencies ascertained by yourself?—No. I learnt about the deficiencies in Malabar from Mr. Viswanath of the Agricultural Department of the Madras Government. With regard to the deficiency in Bihar, I found a reference to it in an article published in the *Agricultural Journal of India* in about 1917.

A.817. You agree that almost nothing is known about mineral deficiencies in India?—Apart from the work which Mr. Warth is struggling so courageously to do at Bangalore there is no work so far as I am aware being done on this subject. I have recently visited Mr. Warth and I am very greatly impressed not only by the magnificent work he is doing under very difficult circumstances but by the great necessity for the extension of his work on the lines laid down by him.

A.818. You are aware that Dr. Orr, who has specially worked on this subject, has indicated the great danger of mineral deficiency in the rapidly growing animal?—Yes.

A.819. Does that suggest to you that if we in India are quite ignorant as to the extent of mineral deficiencies, there may be some danger in attempting to increase the size of our stock rapidly by improving the bulls?—Yes; it will be largely labour lost, because you may get an improvement in the first generation and thereafter the cross-bred stock will most certainly deteriorate.

A.820. Is there not a great danger of death in the first generation?—There is, I am speaking now from memory; I seem to remember having read that the mortality among these cross-bred animals is very much higher than the mortality in the country-bred animals.

A.821. That is the particular point to which Dr. Orr drew our attention, in the recent report on Kenya?—Was it?

A.822. You said in connection with livestock much more work has been done on minerals than on vitamins?—Yes.

A.823. Is it not the case that Dr. McCollum started the work on minerals and then went on to vitamins?—Dr. McCollum originally started with food mixtures generally; vitamins were only discovered shortly before the War.

A.824. Within the last eight or ten years a great deal of work has been done?—He first started with minerals and then went on to vitamins.

A.825. In Great Britain have you heard of the work of Drummond, Zilva and Golding? They are working on domestic animals?—They are.

A.826. In fact the work on vitamins was much more substantial in volume than the work on minerals until within the last two or three years?—Within the last few years, especially in 1925, there has been a great output of work.

A.827. Investigators originally began working on vitamins and found that sometimes vitamin was not as important a factor as minerals; they switched on from vitamin to minerals about 1923?—Quite so.

A.828. Is it now definitely accepted that vitamin E does exist?—It is a recent arrival in the vitamin field; it has been accepted.

A.829. You do not suspect that it is vitamin B?—My own definition of 'vitamin' is a wide one; I mean by it all those substances in food which

exist in very small quantities whether they are organic or inorganic of which we do not yet know the action.

A.830. You have no proof as yet that old canal irrigation affects the quality of wheat?—Not as yet. It is with regard to loamy soil that I made that statement.

A.831. If we get such results as have been got by you and Dr. Norris in Coimbatore, it is difficult to accept the view that canal irrigation would not have an effect upon the quality of the crop?—You think it would have an effect?

A.832. Yes?—As I said, this work is still in progress.

A.833. Indirectly through its effect on the mineral constitution of the soil?—Obviously the quality of the soil and the kind of soil are going to have a great effect. We are going to find, I think, different effects on loamy soil and sandy soil.

A.834. You used one very illuminating word when you were talking of the addition of vitamin or the need for vitamin; you referred to the "spark" of the vitamin being wanted to make the rice effective. I think the illustration is a familiar one. Would you agree that if we use the metaphor of the car we might compare the effect of the rice to the influence of the petrol in the working of the car and the vitamin to the sparking plug?—That is what I said.

A.835. Then, you agree that provided the rice has the necessary addition it is a most valuable food?—Yes.

A.836. Would you agree, to use a common phrase, that one of the reasons why wheat is so much more valuable universally than rice is that the one is more or less a fool-proof food and the other is not?—That is a very good expression. Whole wheat is a fool-proof food. The energy value of rice and wheat in equal amounts is precisely the same. For instance, one ounce of rice has a calorific value of 104, whereas one ounce of wheat has a calorific value of 103. But the difference in the nutritive value of the two grains is enormous.

A.837. *Sir Henry Lawrence*: If a man eats wheat he will find all the necessary elements for his nourishment provided he takes milk. But if he eats nothing but wheat he also will get ill?—Yes. In much the same manner as if you give the engine of your car petrol but not enough oil it will get out of order. Similarly if you give a man only wheat, you will cause him to get ill. You must have a natural balance in all these things. One of the great troubles in this country is that people cannot provide themselves with the other substances to make good the deficiencies of rice.

A.838. If you have to put in this natural balance, I do not understand what you mean by "fool-proof?—Wheat is in itself fool-proof; but it does not in itself constitute a complete food.

A.839. You cannot injure it?—No, unless by making it into wheat flour.

A.840. *Sir Thomas Middleton*: Is it not the case that the feeding of cattle and goats on village refuse is usually accepted as a proof of mineral deficiency?—It is usually.

A.841. So that wherever such a state of affairs is common the position ought to be closely investigated?—It ought to be; it is certain that there is a deficiency.

A.842. *Dr. Hyder*: I want to put a few practical questions with regard to this matter of nutrition. You said to the Chairman that you had no one to whom you could hand over your work. I wonder whether you are acquainted with the internal working of Indian Universities. Supposing our M.Sc.'s in Bio-chemistry, medical graduates, or agricultural graduates, were placed under you for training, could you initiate them into the methods of research, and go away with the confidence that they would carry on your work?—Do you ask me whether I could do this?

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A.843. No. I ask whether you think that graduates who come out of our Universities with Degrees in Bio-chemistry, Physiology or Medicine could undertake work of the kind which you are carrying on?—My present opinion of such Indians as have served under me is that nutritional work particularly appeals to them, and personally I would be hopeful that amongst, say, every hundred men, who would pass through my laboratory there would be seven or eight who would be capable of undertaking original research in nutrition. I should not expect to find very many more. But those hundred have not passed through my hands, and until you see a man working, how he shapes and what thoughts arise in his mind when he sees a piece of work in front of him, you cannot say how he will turn out.

A.844. Is the University of Madras taking interest in your work?—I know that the medical profession of Madras generally takes a very great deal of interest in this work.

A.845. I wonder whether they have a Chair for Bio-chemistry in the University of Madras?—I do not know whether there is or there is not at the present time, but a Chair for Bio-chemistry is a very important addition to any University.

A.846. Passing on to another point, you know that some Indians have taken to European modes of living. I was wondering whether they were not after rising from one pit going to fall into another pit?—Many of them would be out of the frying pan into the fire.

A.847. You know that lemons are very largely used in this country. As soon as people become Europeanised they take to aerated waters, such as lemonades, and tinned foods, and also perhaps to polished rice. I was wondering whether the higher incidence of disease among educated Indians was due to their adoption of European ways of living?—In answer to this question I would say that each Commissioner who cross-examines me suggests other lines of nutritional research. In order to answer your question, it is necessary to extend the facilities for the investigation of such nutritional problems.

A.848. For instance, healthy and big-boned students from the north who come from their villages and are drafted into these colleges and Universities lose their vitality; that is my experience as a teacher in a Northern University. I was wondering whether the change was due to their adoption of European ways to some extent?—That is one of the things which we will be very happy to ascertain for you provided you give us your help to start an institute of nutrition.

The Chairman; Probably Dr. Hyder may be content to know that it may not be due to their adoption of European customs; there may be deficiencies in their diet not necessarily present in European diet.

A. 849. *The Raja of Parlakimedi*: You say beriberi is confined entirely to the East Coast of this Presidency; is it because it is a rice eating area?—Yes; beriberi occurs only within about 45 miles of the coast in the rice growing areas; it exists in the North East Coast of this Presidency, from Ganjam downwards.

A.850. There are, of course, favourable climatic conditions for the production of the disease?—The climatic conditions are certainly favourable for its production.

A.851. Have you got the full history of the beriberi disease?—We have succeeded during the last year in producing true beriberi in my laboratory; we have had 175 cases of it produced in animals, and I think now we can safely say that we know a great deal about it; we certainly know how to prevent it but whether we shall be able to find the actual causal factor of the disease remains to be seen. It is not a matter of very great practical importance. Whether we say that beriberi is due to an undiscovered substance X and whether we find that substance or not, we certainly know how to prevent the disease.

A.852. Is there any objection on the part of the department to have all that published in the vernaculars?—No; I think that is one of the reasons.

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why the work on this subject should be extended; there should be a Publicity Department as part of a Department of Nutrition. All these things which we ascertain in the course of our work should be put into simple language and widely published in the vernacular papers.

A.853. Can it be undertaken by any private individuals on application?—I should think it can be; I do not see any reason why it should not be, but that is a matter, of course, for the authorities concerned to decide.

A.854. *Sir James MacKenna*: I understand you are of opinion that the work you are doing at Coonoor and the work that Mr. Warth is doing at Bangalore and the work that is being done at Coimbatore on nutrition should be linked up?—Yes.

A.855. Would you like that work concentrated in one institute?—Not necessarily so.

A.856. You think it is possible to work up a link between the three existing agencies?—Yes.

A.857. Or would you prefer to have the whole thing under one roof?—I do not see any particular point in that; there is more room for expansion of the work as it exists at present than if all the three were situated in the same building. For instance, work on animal nutrition would have to go on being done in Bangalore, as there is no space for it at Coonoor. The work on human nutrition would have to go on being done in a reasonably good climate, because after all the output of work is entirely dependent on the man doing it, and he will do much better work if he is in a reasonably good climate than he will if he is in a bad one; that is the reason why I am doing my work at Coonoor; it would not suit me so well to do it elsewhere.

A.858. You would not like to have a central institute on nutritional research which would be working through all these three branches as at present?—Yes.

A.859. The relations are apt to break down if we merely link them up; you would have no objection to calling it a central institute on nutritional research working in all these three branches?—No.

A.860. Have you sufficient work for yourself and a full-time Bio-chemist?—I have sufficient work for half a dozen Bio-chemists.

A.861. You emphasise the very considerable possibility of getting capable young Indians to carry on this work, but the facilities for teaching would not be so great if the work is scattered in different places as they would be if you had a central institute?—Any young Indian taking up this work would have to take up one department of it; if he came to me, for instance, to do human nutrition, he would probably stick to it for the rest of his life; he could always visit the other centres and see what is going on there for educational purposes.

A.862. From that point of view, a scattered arrangement would not be any good?—I do not think so; it is an important matter for instance to extend the work at Coonoor. The jam factory is a building I wish to acquire, because, as I told the Chairman, it is very suited for work on nutrition, and it has been suggested to me by the Director of Agriculture of the Madras Presidency, that it would be an excellent thing if the work which Mr. Viswanath and myself are doing could be carried on by a Bio-chemist of the Agricultural Department, who, if he had the buildings of the jam factory, could do so under my direction.

A.863. The moment you have the jam factory, you begin by pooling in that place one of the connected branches of the work?—Not quite that. Their idea is that it would take the man a good year or more to learn how to do these experiments; it is not merely a case of having half a dozen rats and putting them in a cage; there is a great deal to learn, and what he would do, would be to learn himself and so teach others. That would be a means of spreading the work, so that routine testing of vegetable foods by biological assay could then go on being carried out by an Agricultural Chemist in other parts of the Madras Presidency.

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A.864. Assuming that you do get the jam factory, you would still retain Coimbatore and just extend your own operations?—Yes.

A.865. *Professor Gangulee*: Apart from diseases that actually break out owing to deficiencies in diet are you of opinion that any such deficiencies leave the body defenceless against other diseases? I mean the response of the body to immunisation?—That has been definitely proven.

A.866. From that I gather that nutrition investigation will throw much light on preventive medicine?—Yes.

A.867. You said in answer to a question put by the Chairman that you are the only research worker in India in this nutrition investigation?—Yes, that is so.

A.868. And this subject of medical research is directly under the Government of India now?—I am working for the Indian Research Fund Association which, I believe, is a private fund, and it is contributed to of course by the Central Government.

A.869. I know; apart from the research fund that you are referring to, the whole question of medical research is under the Government of India directly. I mean the question of medical research as a general subject apart from the Indian Research Fund Association?—There is no other research financed except by the Research Fund Association, so far as I am aware.

A.870. It is rather difficult for me to understand why the Government of India has not taken adequate interest in that work; is it lack of equipment or lack of interest?—How do you mean the Government of India has not taken an interest?

A.871. Because, you say you are the only research worker in India?—The Government of India, I take it, has got other fish to fry as well as nutrition research.

A.872. Do the medical officers belonging to the superior grades receive training in research work in dietetics? Do those of them who come over to this country get any training?—If you mean young members of the I. M. S., nowadays they get intensive training.

A.873. Before they come over to this country?—Yes.

A.874. It is not lack of trained men? We can get trained men for the purpose, if you have the institute?—You can get men who know their A. B. C., they can read, so to say; no man is trained until he has been through the mill and attempted to do the work himself. Research itself is difficult; what I mean is that there are several kinds of research; the man may simply follow in the lead of somebody else.

A.875. And cannot take the initiative?—Yes. For research in this country we want men with imagination and capacity for initiating it.

A.876. Do you suggest that such workers cannot be found in the superior grades of the service?—No, I do not suggest anything of the kind. I consider still that there is no function of medicine which cannot be fulfilled by officers of the service to which I have the honour to belong.

A.877. Do the Government of India send men abroad, either to America or Japan, for training?—They sometimes do.

A.878. In 1923, I understand the Rockefeller Foundation made an offer?—Yes.

A.879. And the Rockefeller Foundation is an international organisation?—Yes.

A.880. Willing to co-operate with any body in any country for the purpose of training in this sort of nutritional research. Could you tell the Commission what the Government of India has done to avail itself of the unique facility offered by this international body?—That, I am afraid, I cannot answer, because I have not had any experience of the Secretariat of the Government of India, and I do not know what they have done in the matter.

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A.881. You are aware of that offer?—I can aware of it.

A.882. I think three men were sent from this country?—Were there three sent?

A.883. To the Johns Hopkins University; what happened to these men when they returned?—I do not know; I think one was Major Shokey, he is now at the Haffkine Institute.

A.884. You are not aware of the conditions on which the Rockefeller Foundation made these offers?—I am not.

A.885. There was a proposal by the Government of India to start nutrition work in this country, and it was suggested to secure the services of Professor Saiki of Japan; are you aware of that?—I have heard that something of the sort was suggested. His services are quite unnecessary.

A.886. Could you tell the Commission at what stage the proposal now rests?—I do not know at what stage the proposal now rests; I know I have not succeeded in finding the name of Dr. Saiki mentioned in nutritional literature.

A.887. He is, I think, Director of the Imperial Institute in Tokio?—Yes.

A.888. Is there any definite proposal before the Government of India with regard to your work, either for its expansion or for its cessation?—One sends up one's proposals for the next year in the usual way; that is all one knows about it.

A.889. You are assisted in your work by a number of Indians?—I have three assistants.

A.890. Are you satisfied with them?—All of them are most admirable.

A.891. Can they do the statistics work well?—They cannot, but I have had the advantage of having the services of the Director of Public Health's Statistical Assistant, who has given me most valuable assistance.

A.892. Which are the most important from the point of view of deficiency, vitamins or glands?—I cannot say. Comparisons in regard to substances essential for metabolism are difficult. They are all equally important.

A.893. What are the criteria of a good diet?—It is a general question. The diet should be perfectly balanced in respect to proximate principles of the food—which are proteins, carbo-hydrates, fats, salts, and water. It also should contain a sufficiency of vitamins without which, as I explained, the normal processes of metabolism are impossible. Those are the criteria of a good diet.

A.894. One word about this Indian Research Fund Association to which you made reference. In what sense do you think it may be designated as semi-official body or organisation?—I believe the Government of India contribute largely towards it. I understand it has a scientific advisory board, and the governing body of the Indian Research Fund Association has a number of officials working on it.

A.895. In the governing body, I do not find a single non-official. Does it consist of officials only?—I do not know. I am not familiar with its constitution, perhaps not so familiar as I ought to be; but to tell you the truth, I have not thought about it.

A.896. *The Chairman*: They send you the money and you do the work?—Yes.

A.897. *Mr. Calvert*: Are you in a position to venture an opinion as to how far poverty enters into this question of nutrition?—I am not in a position to do so. It is outside my kind of work.

A.898. Ordinarily one would expect that unpolished rice should be cheaper than polished rice and white flour?—Yes. But if people bought *atta*, they would not be doing themselves an injury, because *atta* is the better of the two.

A.899. In the case of the army rations, I think the rice eater's ration is actually more expensive than the *atta* eater's ration?—Yes.

A.900. In the case of a man not necessarily affected by poverty, it is a question of unsuitability of the actual diet?—Yes. Many of the better class of people in England feed themselves unsuitably.

A.901. Have you made a study of the food consumption by cultivators in the special tracts of the Punjab?—I have not.

A.902. There was an enquiry by a Colonel of the Indian Army Service Corps, the Inspector-General of Prisons, the Superintendent of the Mental Hospital and a Professor of Physiology, who discussed the dietary from various points of view. Do you think similar enquiries into the dietary of the rural classes would be of any help?—Yes, of immense help.

A.903. I see the army ration scales have been worked out to give a complete ration, with vitamin values also. Is that scheme approved by you?—It has not come to me for approval.

A.904. It was issued by the Director of Medical Services?—It has not come my way.

A.905. In answer to a question from Sir Henry Lawrence on this question of milk, you said that milk was a very important item; but in a very large tract of country in China, Japan, Burma and Siam, milk is not part of the diet at all. How do you reconcile that with your remark about milk?—I should imagine that the people in the tracts you refer to are not of good physique or that they use other foods, such as fish, which may to some extent compensate for the want of milk. For instance, in Japan there is more beriberi than probably in the rest of the world, all the countries put together. Obviously, Japanese do not receive enough protein; otherwise, they would be bigger people.

A.906. You say that milk is very necessary; but still the Japanese and Chinese as a race have been in existence for some thousands of years?—There is no reason why they should not continue to exist but their physique is smaller.

A.907. The constitution of the Burman may be due to his not taking milk?—Yes. None of those countries are very healthy countries.

A.908. Is *dal* not an adequate substitute for milk?—Not for milk. It is an excellent substitute for mutton. It does supply a sufficient amount of protein; there is no substitute for milk.

A.909. *Dr. Hyder*: Have you ever seen a tall Japanese or Chinaman?—I have never been either to Japan or China.

A.910. *Mr. Kamat*: As national habits of diet cannot be changed in a day, I should like to know what advice, for instance, you would give to the Madras people to attain the same efficiency as the Punjab people, say, for example taking more pulses and *dals* in their food, for the time being?—The answer to that is this: that there is only a certain amount of pulse or *dal* which they can take. Everything over about 4 ounces of pulse will be useless. They cannot deal with it. The protein which the pulse provides they cannot assimilate. So it will remain in the intestines and will give rise, as Colonel McCay showed 14 or 15 years ago, to another sort of disease. So, even with the pulses there is no hope for them to rise to the same standard of physical efficiency as in the Punjab. If, however, they consume more milk and green vegetables, then they can attain a reasonable state of physical efficiency.

A.911. I want to know also the value of pulses *versus* meat. Can those, who do not touch meat and depend on pulses, have the same efficiency as meat-eating people?—Provided the rest of their diet is complete, provided they take a sufficient amount of milk, they will do admirably on pulses.

A.912. So the whole question comes back to milk?—Yes, it comes back to milk and to the balance of food.

A.913. *Mr. Calvert*: But milk is not part of the army ration?—The men get *ghi* in its place.

A.914. *Mr. Kamat*: There is just one question about publicity. Would it be possible to embody your results into school text-books in simple language,

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including also the charts on a small scale?—It would be quite possible. In the institute of nutrition, which we are all thinking about, there will be some man who will be specially engaged in the production of these pamphlets, because it will take a man all his time to do it. It would not be possible for me.

A.915. With Indian assistants?—Yes.

A.916. For the benefit of the succeeding generations?—Yes, to the great benefit of India.

A.917. What is the amount of the annual grant made from the Indian Research Fund roughly?—I think including my pay, I get about Rs. 70,000 per year.

A.918. And if you want more money, I believe it will be available from this Fund?—When I have been actually working for the Fund I have not so far been stinted for money for my researches.

(The witness withdrew.)

The Commission then took oral evidence of Major-General F. H. G. Hutchinson for which see Volume III and then adjourned till 9-30 a.m. on Monday, the 30th November, 1926, in Calcutta. For the proceedings of meetings from 30th November to 7th December 1926 (excepting the evidence of Dr. E. H. Pascoe which follows), see Volume IV.

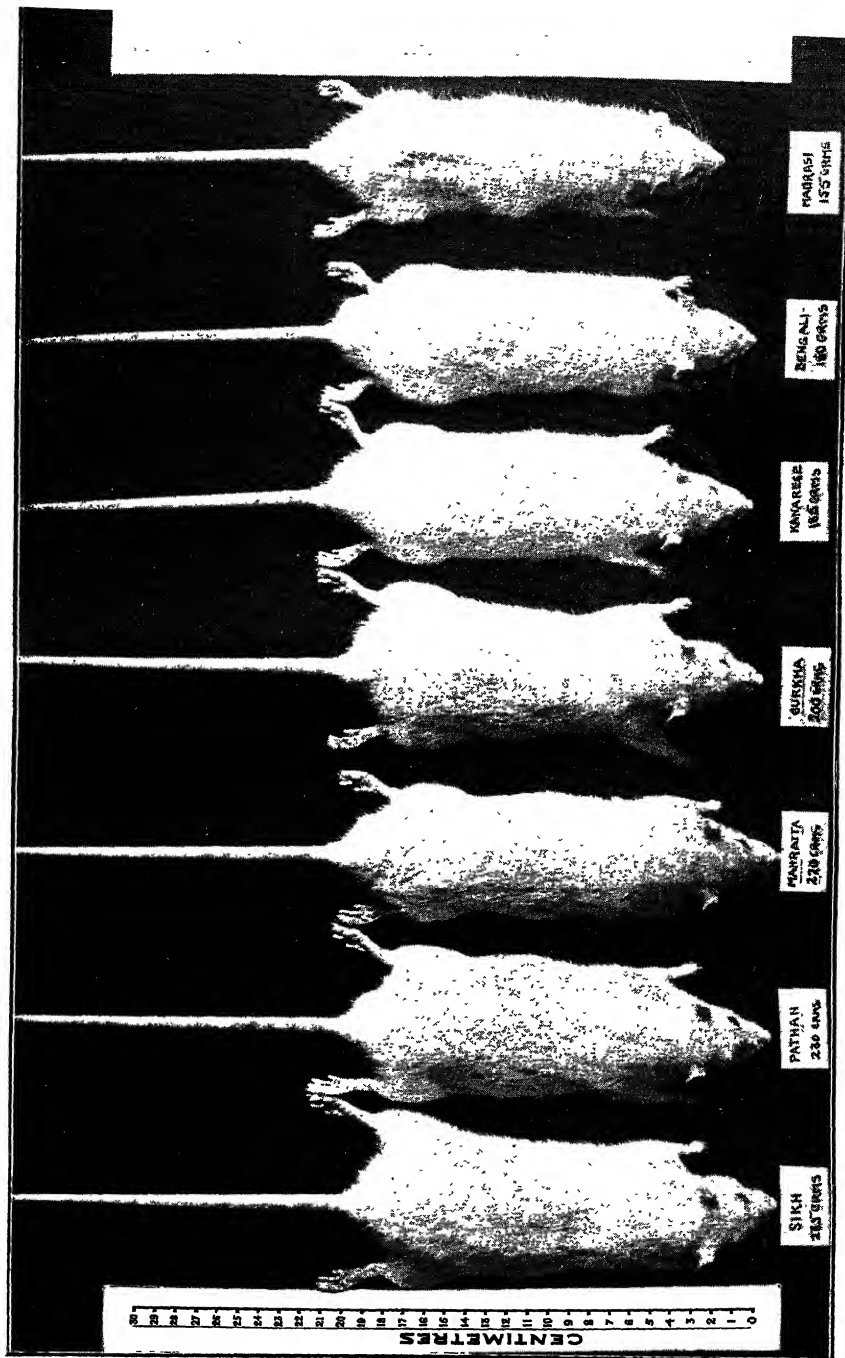


FIG. 1.

Shows the relative values of certain National diets of India (*vide* text of Evidence on page 101 and Chart E). The rats selected represent in each case the *average* weight of the animals in their particular group. Photograph taken on the 140th day of the experiment. Compare Chart E showing the percentage increase in body-weight on the 80th day of the experiment.



"Good Diet"

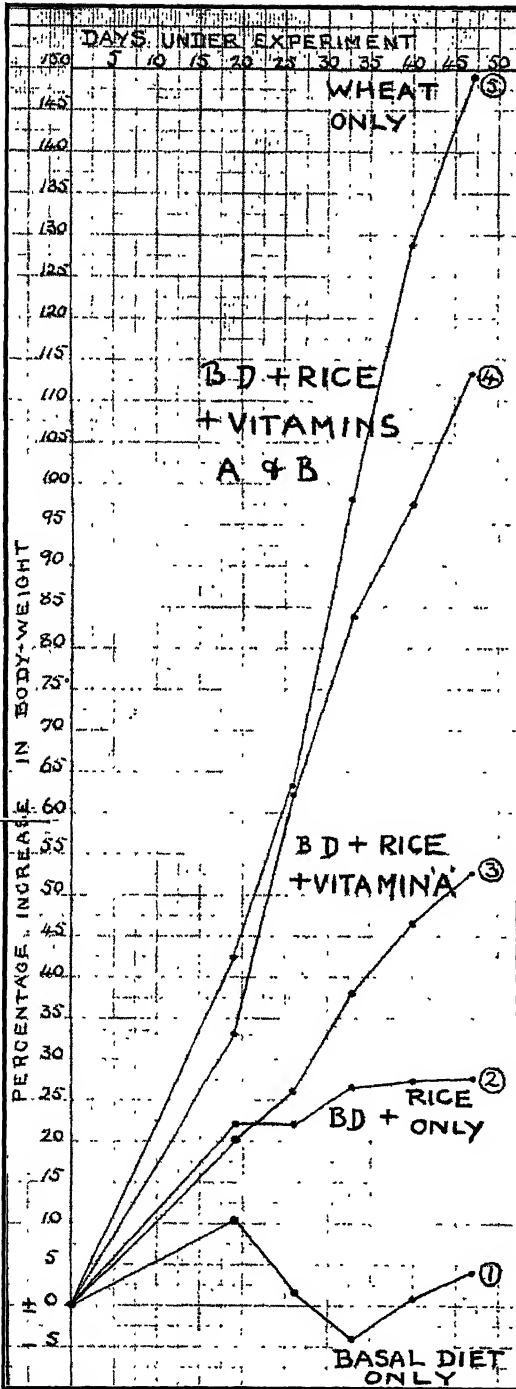


"Bad Diet"

FIG. 2.

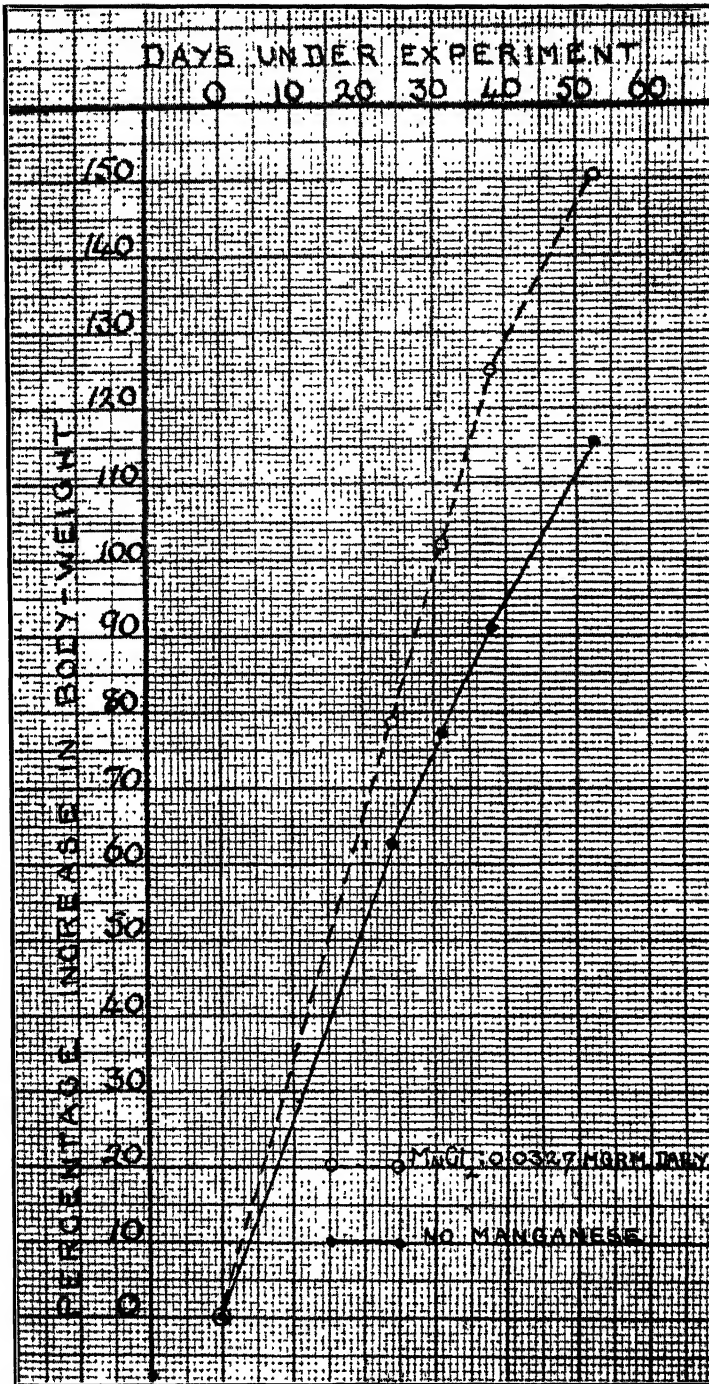
Shows the effect on rats of a "Good diet" and a "bad one." The former was such as is used by the Sikhs; the latter such as is used by many Europeans of the poorer classes (*vide* text of Evidence on page 102). The latter diet is no better than the diets of Bengal and Madras; in some respects being worse.

CHART B.

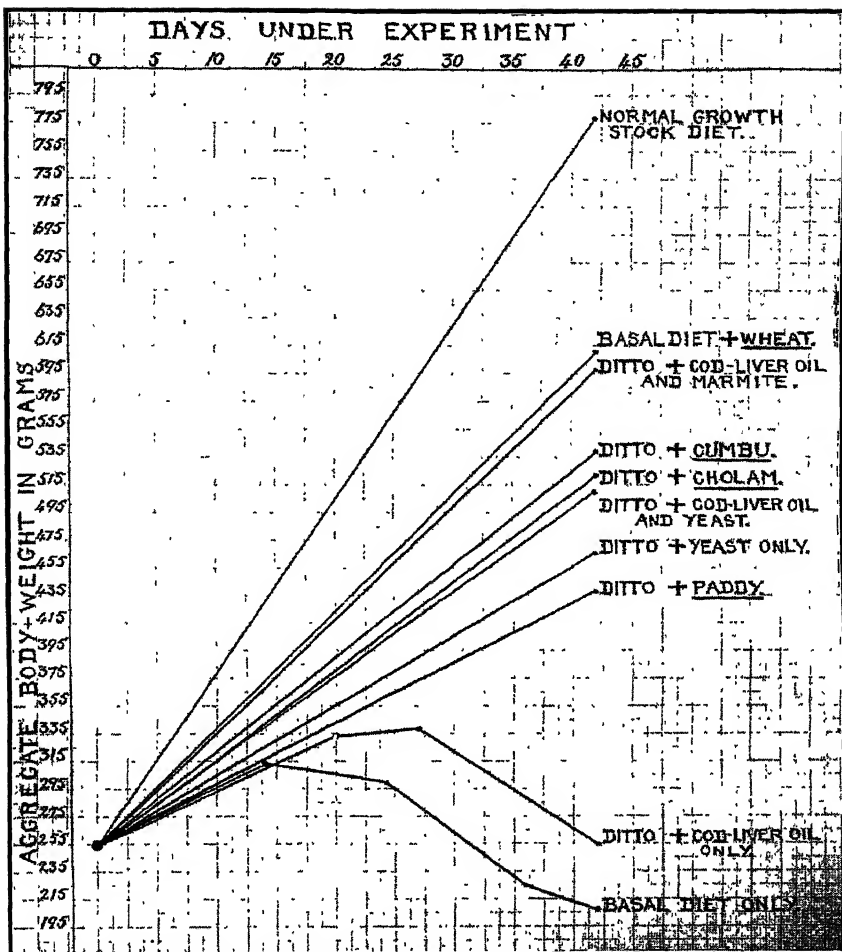


Five groups (six in each) of young rats of the same initial weight, age, sex, and growth potential, were fed on a basal diet containing proteins, fats, carbohydrates and salts in proper amount and proportion but without vitamins. One (1) received this diet only; a second (2) this diet *plus* one gramme of *whole rice* as the sole additional source of vitamins; a third (3) received the same diet *plus* one gramme of *whole wheat* as the sole additional source of vitamins. Note the remarkable difference in nutritive value between whole rice and whole wheat. The addition of vitamin-A to the diet containing whole rice (3) did not improve it greatly, while the addition of both vitamins A and B did (4); thus demonstrating the fundamental poverty of whole rice in these two vitamins. This addition did not, however, make the diet containing rice equal to that containing wheat. The reason being that rice is also poor in certain inorganic salts, notably manganese.

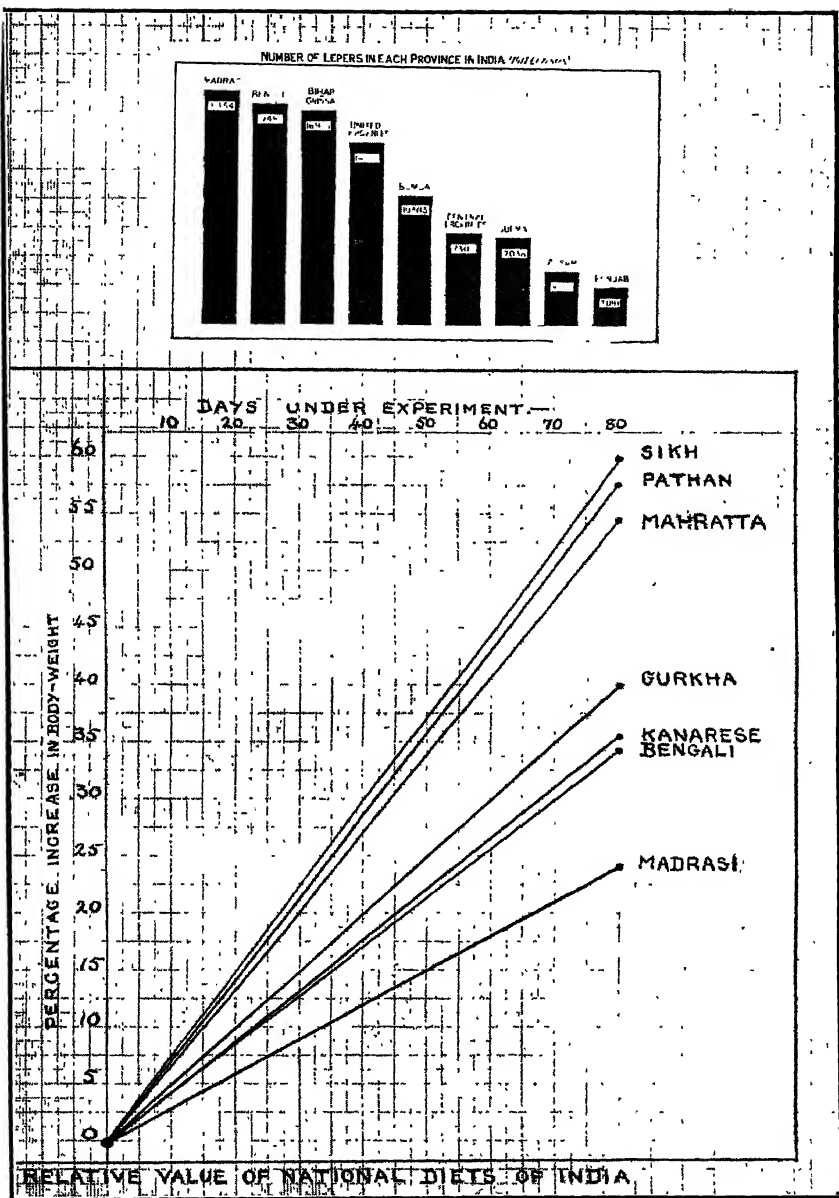
CHART C.



Two groups (six in each) of young rats of the same age, sex, initial weight and growth potential, were fed on a synthetic diet complete in every respect as regards proteins, fats, carbohydrates, salts and vitamins. But to the diet of one group manganese chloride was added in amounts proportionate to that present in a wheat-eater's diet. The pronounced effect of this small amount of manganese on the growth of the young animals is seen in the chart (in this and in all other experiments the similarity in growth potential was ensured, as far as possible, by selecting the animals for each group from a number of different litters).

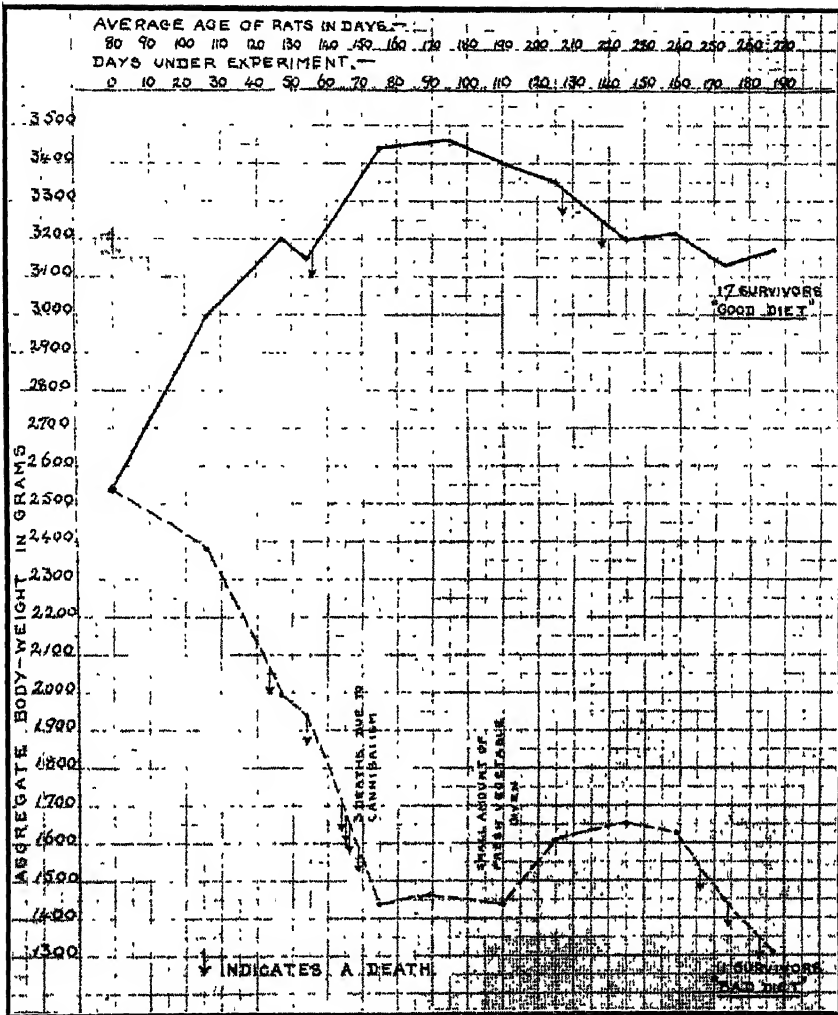


This shows (1) that no growth results from a basal diet which contains no vitamins although it is complete in all other respects (lower curve); (2) that the addition of cod-liver oil to this diet—which provides vitamin-A—does not improve matters much (second curve); (3) that the addition of cod-liver oil and yeast which provides both vitamin-A and vitamin-B does result in fairly good growth (fifth curve), this growth being better still if the source of the vitamin-B is marmite instead of yeast (eighth curve); (4) that the addition of yeast alone (fourth curve) gives almost as good growth as yeast and cod-liver oil (fifth curve) showing that the olive oil used in the basal diet contained some vitamin-A; (5) that when one gramme of wheat or *cumbu* or *cholam* or paddy was added to the basal diet as the sole additional source of vitamins, wheat was found to be by far the richest in those substances so necessary for growth, and paddy by far the poorest; while the other two grains occupied an intermediate position in this regard; (6) that one gramme of wheat gave as good growth as cod-liver oil and marmite put together and better growth than cod-liver oil and yeast and (7) that no artificial diet was as good as the natural "stock diet" used which consisted of *chapattis* of *atta*, sprouted grain, milk, butter, green leafy vegetables, fruit, tubers, roots and fresh meat once a week.

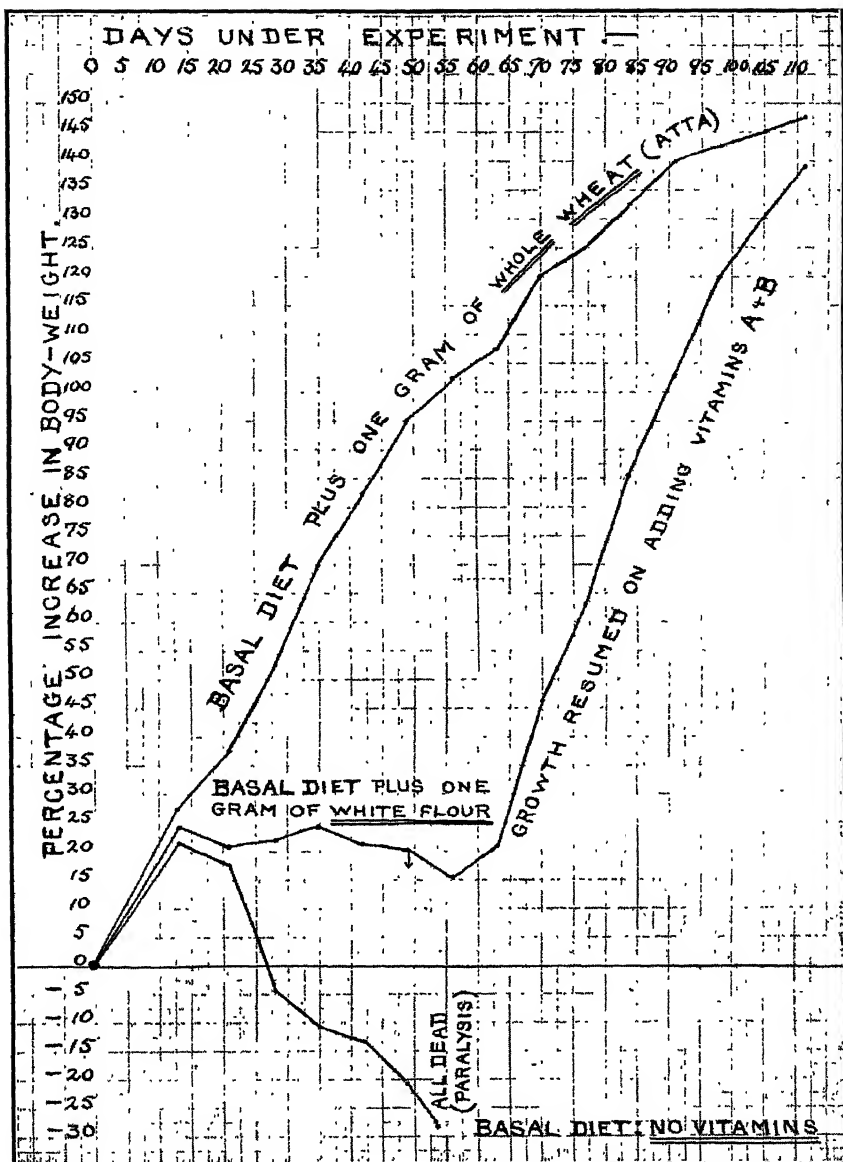


Seven groups of twenty young rats of same initial weight, age, growth potential, and sex, were placed in separate cages and under precisely similar conditions of life. Each group was fed on a diet such as is used by the race the group represented. The diets of the wheat-eating races—Sikhs, Pathans and Mahrattas—were the best, in conformity with the fine physique and military history of these races. The diets of the rice-eating races—Bengalis and Madrasis—were the worst, in conformity with their smaller stature or poorer physique and poorer capacity for hard work. The addition of such articles of food as milk, butter, meat, etc., greatly improved the rice-eater's diet. Contrast, for example, the Madras's diet with that of the Gurkha (the latter eating meat more frequently). The Kanarese are millet (*ragi*)-eaters; the Mahrattas use half rice and half wheat or *bajra* with milk and milk-products. The upper chart shows the much higher incidence of leprosy in the more poorly nourished races.

CHART H.

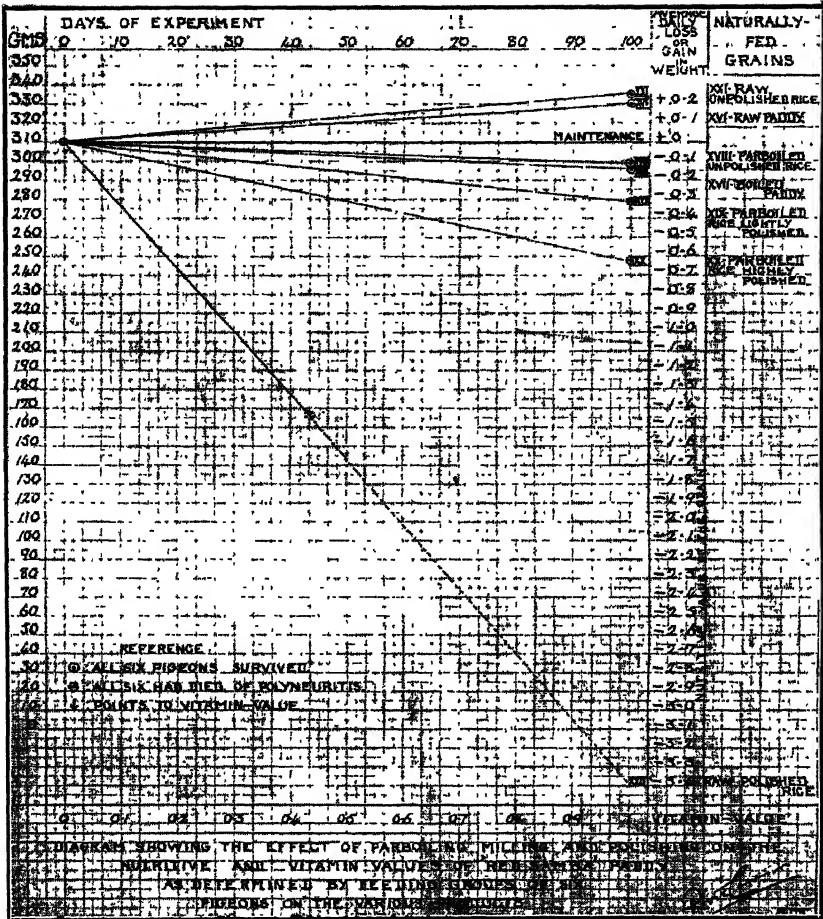


This shows the difference in nutritive value and health-sustaining properties between a "Good Diet" and a "Bad Diet." Two groups of 20 half-grown rats of the same initial weight and growth-potential were fed on these two diets, there being the same number of males and females in each group. The "Good Diet" consisted of *atta chapattis*, milk, butter, green vegetables, sprouted gram, raw potato, carrot, tomato (as substitute for fruit), water and fresh meat once a week. The "Bad Diet" consisted of white bread, tea, sugar, margarine, a little milk to add to the tea, preserved meat, boiled vegetables, jam. Each group ate as much as they wanted. The weight curves show how the former flourished and how the latter did not. No doubt the food preservatives (sulphurous acid, boracic acid and formaldehyde) present in some of the ingredients of the "Bad Diet" contributed to its ill-effects. These preservatives are present in jam, margarine and preserved meat.



This shows the difference in nutritive value between whole wheat flour (*atta*) and American white flour. Three groups of young rats (six in each) of the same age, sex, growth, potential and initial weight, were fed on a basal diet complete in every respect but devoid of vitamins. One group (lowest curve) received this diet only and the animals failed to grow, lost weight and died of paralysis of the hind limbs. A second group (second curve) received this diet *plus* one gramme of American white flour as the sole additional source of vitamins. The animals in this group grew for the first 14 days of the experiment when growth ceased. They did not, however, become paralysed showing that white flour contains some anti-neuritic vitamin (hence beriberi is rare in Europe and America) but was very poor in a growth-promoting vitamin. A third group received the same basal diet *plus* one gramme of whole wheat flour (*atta*). At the point marked with the arrow on the second curve vitamin-A was added to the white flour diet. It did not improve the rate of growth. At the end of a fortnight vitamin-B was added,

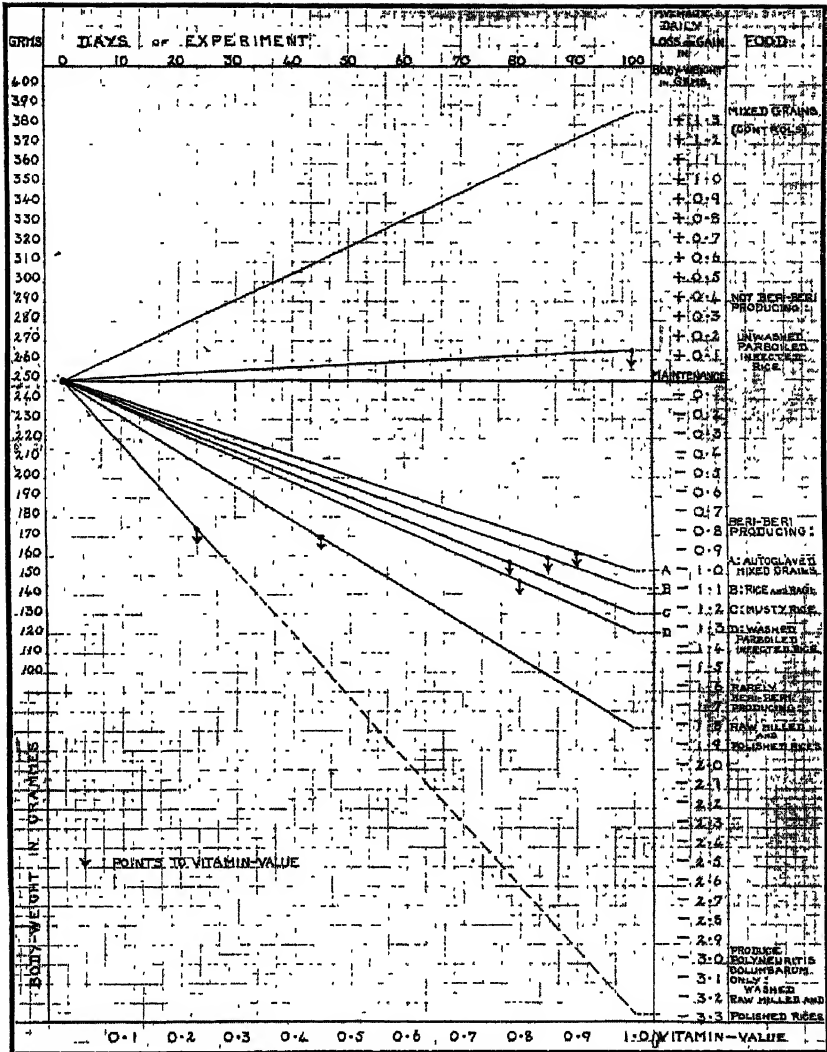
CHART J-1.



This shows the effect of parboiling, milling and polishing on rice. This was tested by feeding groups of pigeons of the same initial aggregate body-weight (and of an average body-weight of 310 grammes) on the various products of a "red Samba paddy." The birds were fed exclusively on these products for a period of 100 days or until death. The raw unpolished rice is the best being slightly better than the raw paddy itself, due, no doubt, to the consumption of a certain amount of unnutritive husk with the latter. In both cases the diet keeps the birds above "maintenance level" (that is, they do not lose weight). Parboiling lowers the value of the rice to some extent (it preserves its vitamin-B but causes loss of vitamin-A): and milling and polishing of the parboiled rice further reduces its value due to loss of vitamin-B and other substances in the process. But even the highest degree of milling and polishing does not remove all the vitamin-B from parboiled rice while it removes almost all if the rice is not parboiled but is milled and polished in the raw state (bottom line in chart). The arrow on this line points to the "vitamin value" of the raw polished rice: 0.38. It ought to be 1.0 to ensure that the birds will be kept at maintenance level.

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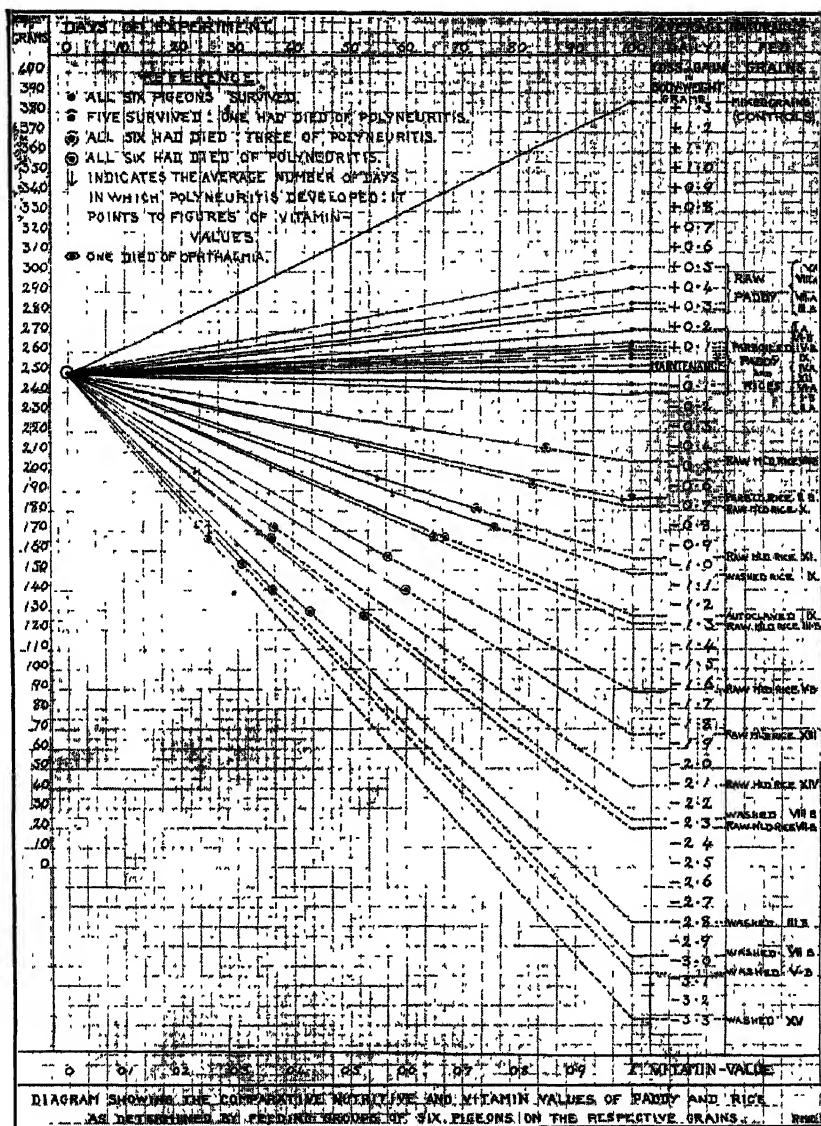
CHART J-2.



This shows the optimum food conditions for the production of the disease called beriberi. This disease is a condition of polyneuritis, with heart disease and dropsy. The basal factor in its causation is a diet—usually composed largely of polished rice—which contains “too little” vitamin-B for “maintenance” polished rice alone does not cause it (lowest line in chart) because the vitamin value of this rice is so low (0·24) that the animals cannot live at all. The disease only arises when the diets, such as those noted as A B C and D on the chart, have vitamin-B values which happen to lie between 0·75 and 0·9—the amount of vitamin-B required for “maintenance” being represented as 1·0. So that if a little *dal* be added to the diet of polished rice so as to raise the vitamin-B value of the diet to say 0·8 then beriberi will arise.

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CHART L.

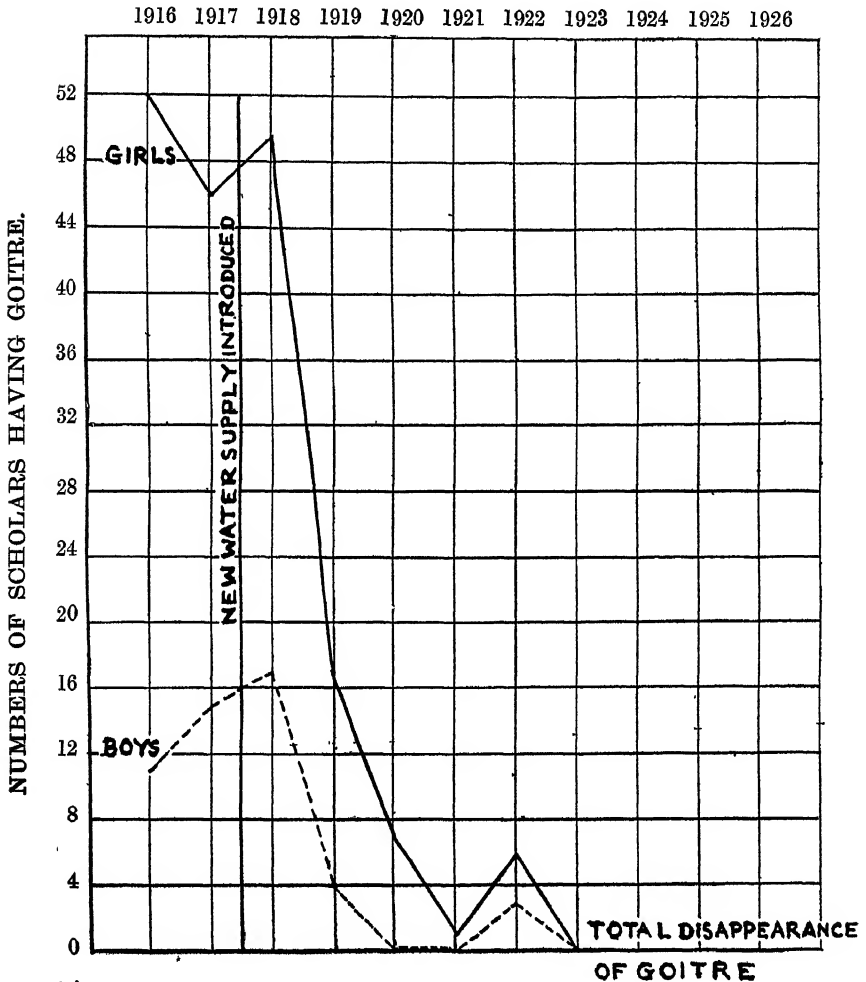


This shows in the same way the comparative values of some 28 rices in common use in India. It will be noted how greatly they differ, due in the main to the degree of milling and polishing to which they have been subjected. The four bottom lines show the disastrous effects of much washing of raw milled and polished rice prior to its consumption. This is due to the fact that vitamin-B is soluble in water, so that any amount of this substance left in the rice may be washed out of it. Other important substances are also washed out in this way: notably phosphorus.

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CHART N.

GOITRE AT THE ROYAL LAWRENCE MILITARY SCHOOL,
SANAWAR.



This shows the eradication of goitre from a school (of 500 scholars) in the Punjab where goitre had prevailed since the establishment of the school after the Mutiny.

CHART P.I.

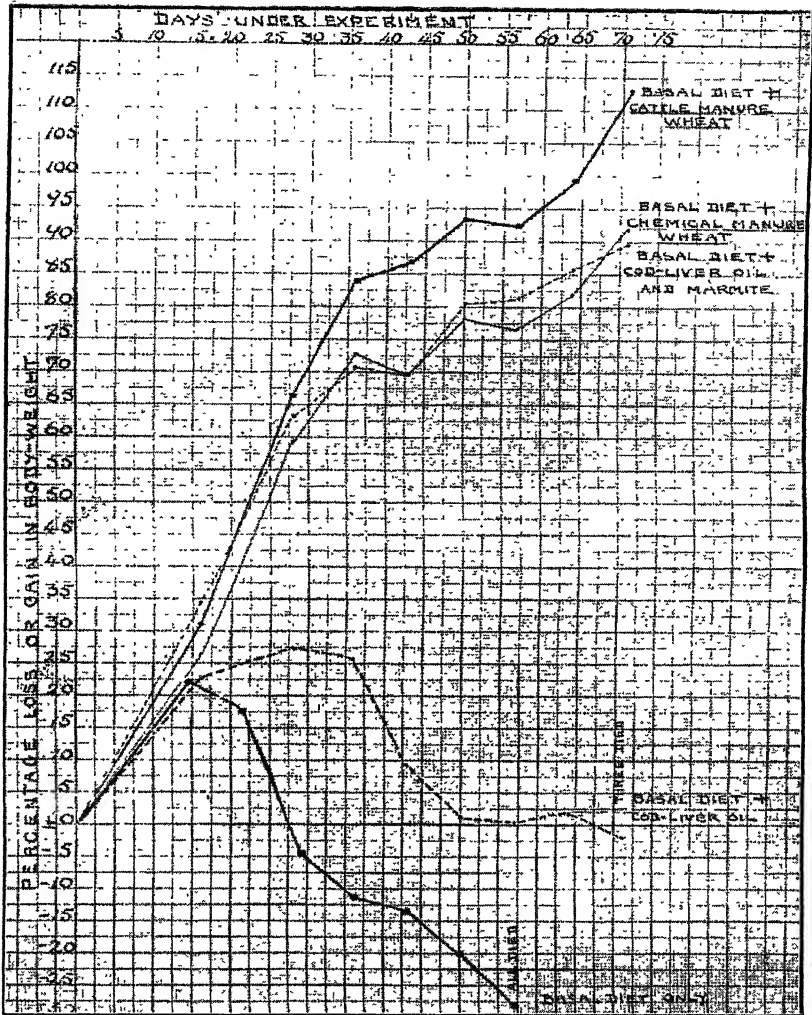
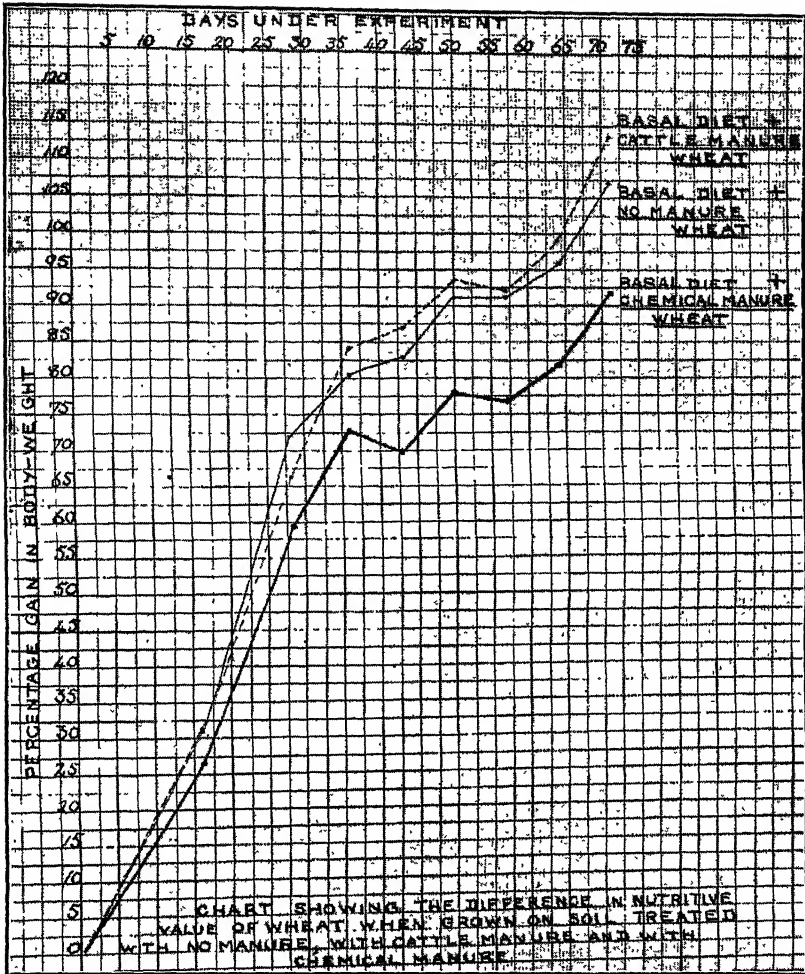


Chart showing the difference in nutritive value between "cattle manure wheat" and "chemical manure wheat."

This shows the effects of manure on the nutritive and vitamin value of wheat. Five groups of young rats were used: one received a basal diet only which was complete in every respect but had no vitamin-B and very little vitamin-A, no growth resulted (bottom curve); another had the same diet *plus* cod-liver oil to provide vitamin-A, again no growth resulted but death was delayed; a third had the same diet *plus* cod-liver oil (to supply vitamin-A) and marmite (to supply vitamin-B) (3rd curve) when good growth resulted; a fourth had the same diet *plus* one gramme of wheat, grown on soil manured with a *complete chemical manure*, (as the sole added source of vitamins) and good growth resulted equal to that given by cod-liver oil and marmite together (4th curve from bottom); a fifth had the same diet *plus* one gramme of wheat, grown on soil manured with *cattle manure*, (as the sole added source of vitamins), better growth resulted. The wheat grown on soil manured with cattle manure is thus approximately 17 per cent better than when grown on the same soil manured with chemical manure. The same result has recently been obtained with oats and *arhar* grown at Pusa.

CHART P-2.



This shows the relative values of the same wheat when grown on the experimental plots at Coimbatore which received cattle manure, chemical manure and no manure at all. It is remarkable that though the yield in grain from the "no manure plot" is so much lower than either of the others, in nutritive and vitamin values it is higher than the chemically manured produce. The same result has recently been noted for oats and *arhar* grown at Pusa; so it is not a chance result.

CHART Q.

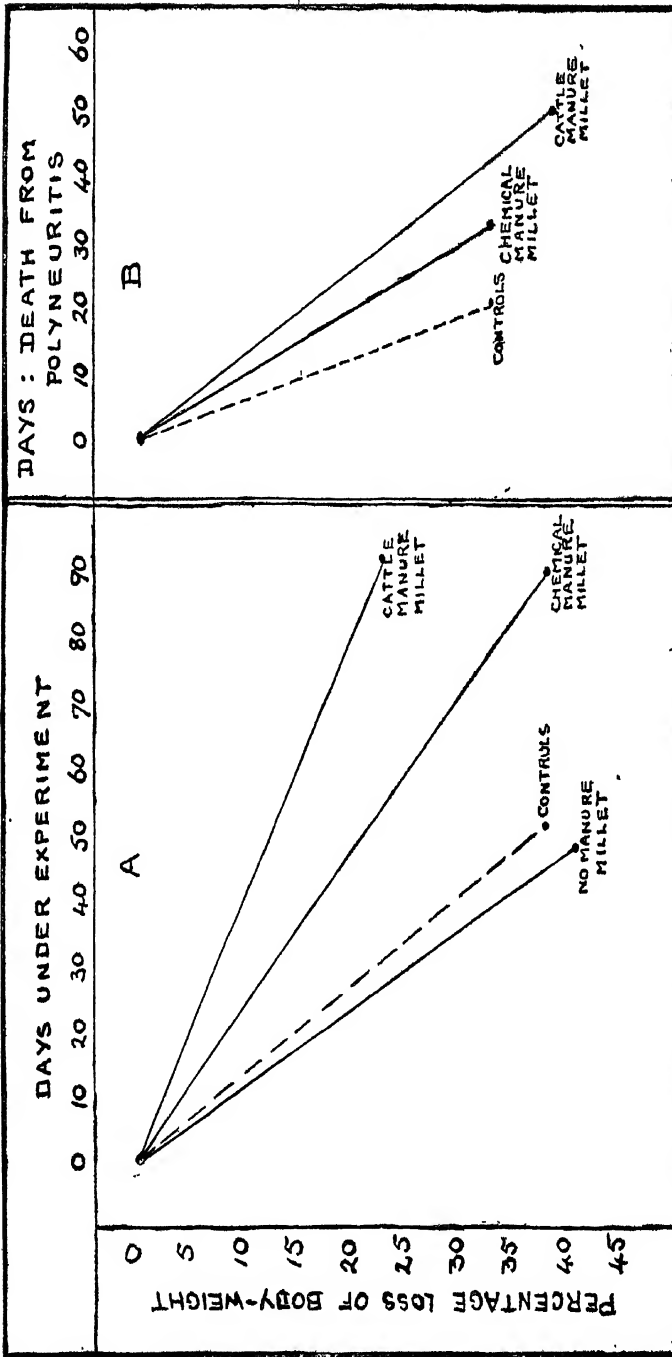
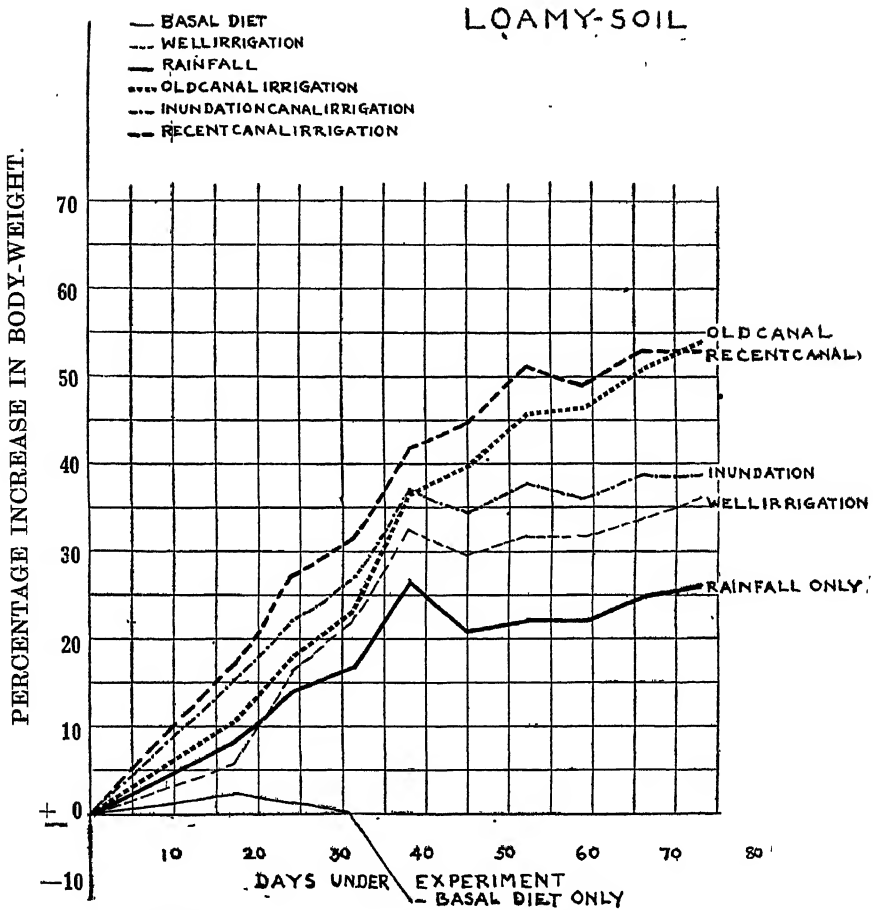


Chart A showing the percentage loss of weight in groups of pigeons, of the same initial aggregate weight, when fed on a basal diet of rice to which 'cattle manure millet', or 'chemical manure millet', was added in the same amount (*vide* text). The controls received the basal diet only. Note that the addition of the 'no manure millet', actually increased the rate at which body-weight was lost and hastened the time of death as compared with controls which received no millet. 'Cattle millet', was markedly superior to either of the other millets in preventing the loss of weight caused by a diet of rice.

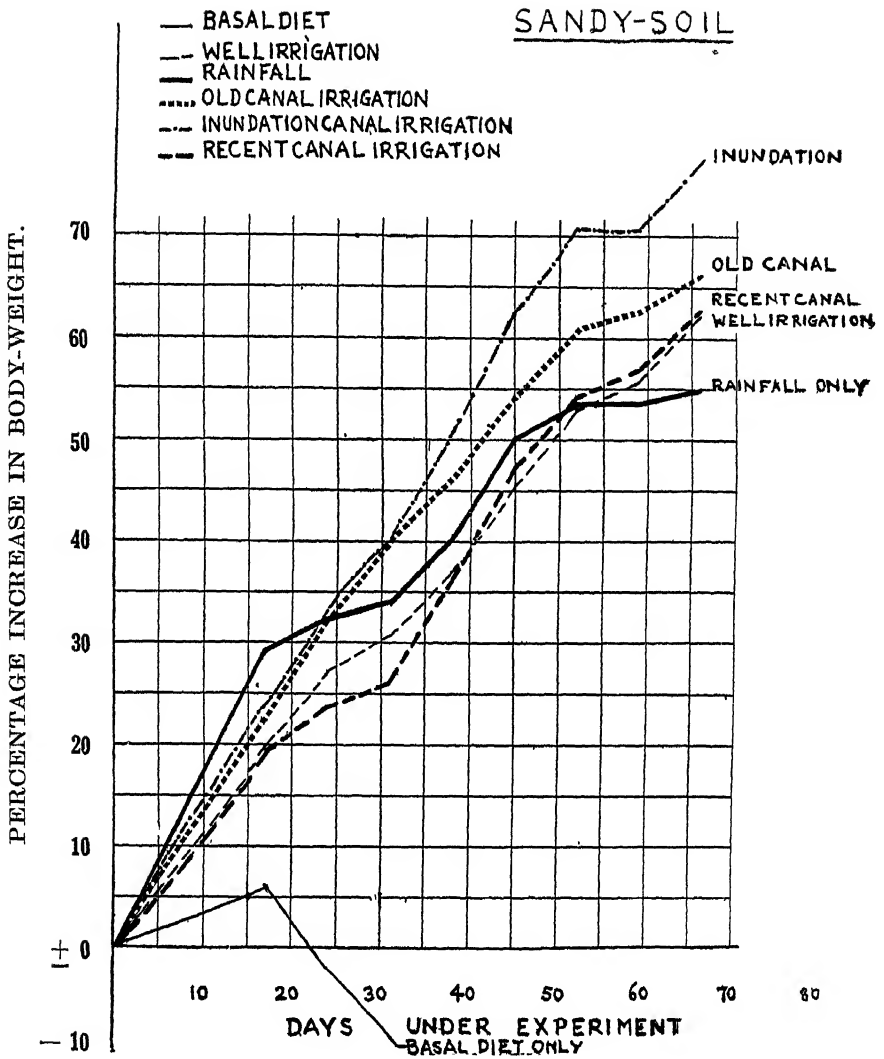
Chart B shows that 'cattle manure millet', was richer in vitamin B than 'chemical manure millet', since, when added in the same amount to a basal diet of raw, polished, washed and autoclaved rice, it delayed the onset of polyneuritis for a longer time. If the vitamin B value of 'cattle manure millet', be taken as 1 that of 'chemical manure millet', is approximately 0.66.

CHART R-1.



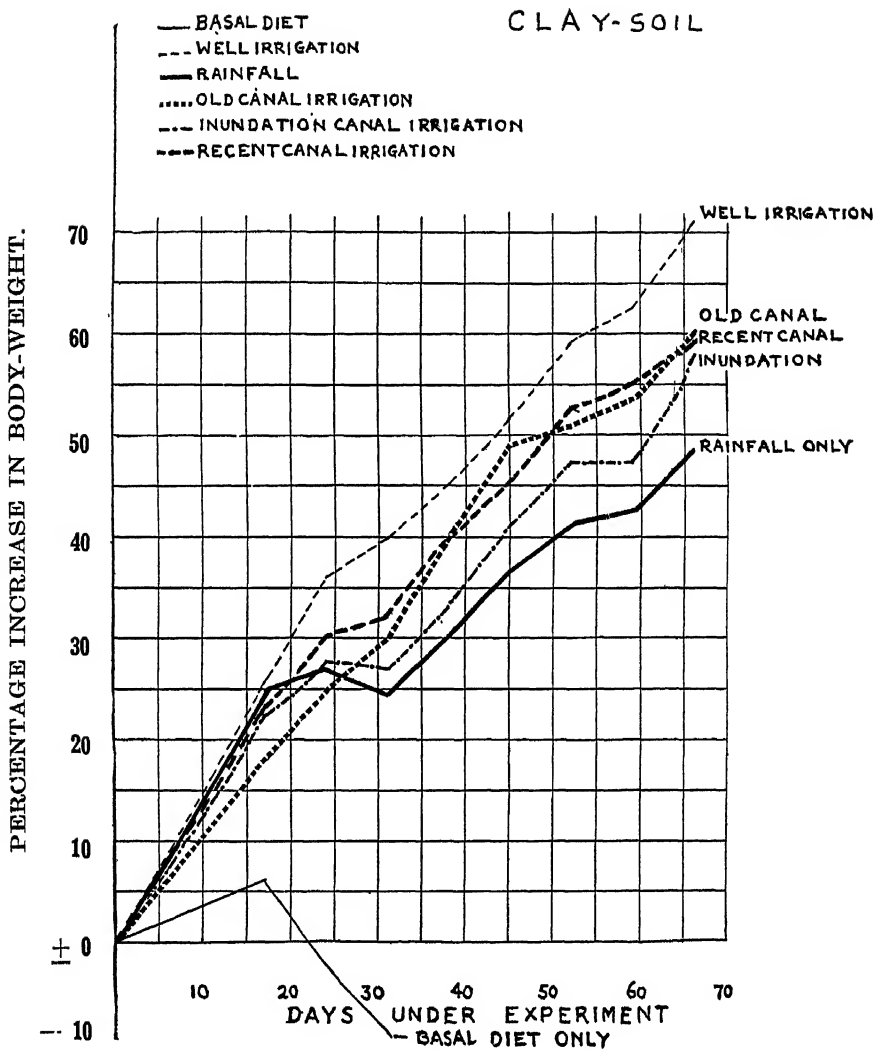
This shows the effect of different forms of irrigation, or water-supply, on the nutritive and vitamin values of wheat from the Punjab. The same wheat was used throughout but grown on loamy soil irrigated in different ways. The same technique was followed: groups of rats of the same age, weight, sex and growth potential, were used and fed on a basal diet which was complete in all respects except that it contained no vitamin-B and little vitamin-A. One group (the controls) received this basal diet only and did not grow; the other groups each received 1 gramme per animal daily of the whole wheat grown on loamy soil irrigated in different ways. The experimental work on this subject is not completed and definite conclusions cannot as yet be drawn, but this and the succeeding figures show that water-supply does make a difference to the nutritive value of the wheat, and that this difference depends to a considerable extent on the nature of the soil.

CHART R-2.



Same legend as for Chart R-1. In this case the wheat was grown on *sandy soil*.

CHART R-3.



Same legend as for Chart R-1. In this case the wheat was grown on *clay soil*.

Tuesday, December 7th, 1926.

CALCUTTA.

PRESENT :

The MARQUESS OF LINLITHGOW, D.L. (*Chairman*).

Sir HENRY STAVELEY LAWRENCE,
K.C.S.I., I.C.S.

Sir THOMAS MIDDLETON, K.B.E.,
C.B.

Rai Bahadur Sir GANGA RAM, Kt.,
C.I.E., M.V.O.

Sir JAMES MACKENNA, Kt., C.I.E.,
I.C.S.

Mr. H. CALVERT, C.I.E., I.C.S.

Raja Sri KRISHNA CHANDRA GAJAPATI
NARAYANA DEO of Parlakimedi.

Professor N. GANGULY.

Dr. L. K. HYDER.

Mr. B. S. KAMAT.

Mr. J. N. GUPTA, I.C.S.

Rai A. C. BANNERJI BAHADUR } (*Co-opted Members.*)

Mr. J. A. MADAN, I.C.S.

Mr. F. W. H. SMITH. } (*Joint Secretaries.*)

**Dr. E. H. PASCOE, M.A., D.Sc., F.G.S., F.A.S.B., Director,
Geological Survey of India.**

Replies to the Questionnaire.

QUESTION 10.—(f) The few remarks I have to offer under this head form a corollary to Dr. Watson's paper published in a Supplement to the *Indian Trade Journal* (Vol. X, 27th August, 1908). The prevention of the waste of this valuable fertiliser evidently depends upon the availability of an equally cheap and efficient substitute. Of the three possible substitutes Dr. Watson showed that according to prices in 1908 kerosene was out of the question, and that wood could compete only in Madras, where it was a cheaper fuel, and in Bengal, where its price was much the same as that of cowdung cake. Presumably wood could have competed also in Upper Assam and the jungly parts of Burma. Dr. Watson showed that the selling price of cowdung cake was entirely fictitious and that its real value was at least $2\frac{1}{2}$ times greater. Cowdung cake, in fact, ought to have been the dearest fuel—dearer even than kerosene oil (see *Indian Trade Journal*, Vol. XIII, p. 307; June 17th, 1909).

I have been unable to obtain in time figures regarding the present-day price of cowdung cake. The average price of Bengal coal was about Rs. 6-12-0 in 1908 and about Rs. 7-9-0 in 1925. I shall assume that the present ratio between the prices of cowdung cake and coal differs to no large extent from the ratio in 1908. Dr. Watson's figure showed that in most parts of India coal was a closer and more promising competitor, and it is on this that I would submit a few remarks.

If cowdung cake were estimated at its real value, we may assume that none of it would be used for fuel purposes, for coal, coke, wood and oil would be considerably cheaper. The more the value of cowdung cake could be brought home to the agriculturist, the higher would rise its price. A point would soon be reached at which other fuels would supplant it, and the first

Dr. E. H. Pascoe.

E (2)

of these in most of the Provinces would be coal, or, more probably, its artificial product, coke.

There are in India large quantities of second grade coal which finds such a limited market that in many cases it does not pay to exploit it. In a poor country like India it is natural to regard it as the ultimate solution of the domestic fuel problem. Very little is known about the quantity and quality of the coal, but the whole subject is at present under investigation by the Geological Survey of India. Dr. Fox, who is superintending the enquiry, has been asked to include in his programme the question of the domestic consumption of all grades of coal and of the soft coke produced therefrom, the coking properties of the various seams investigated, and, if possible, to some extent the improvement and cheapening of transport. The re-survey of the coal fields will take another two or three years to complete. Any suggestions now made are made in anticipation of the results and are necessarily somewhat indefinite.

The reason why coal or coke is not competing to a sufficient extent with cowdung cake as a domestic fuel amongst the masses of the population is for the most part one of price. Much of the second grade coal of India is lying unworked, because the market price obtainable for it is too low to allow of its being raised remuneratively. If the price of cowdung cake were raised as a result of propaganda work to a sufficient figure, it would bring the second grade coal into the market as a competitor. A large proportion of this coal—Dr. Fox believes the greater part of it—will yield a soft coke eminently suitable for the domestic *chulha*. The coke is a little more expensive, heat for heat, than the coal, as Dr. Watson's figures show, and the price of cowdung cake would have to be increased accordingly before the coke could compete.

With a suitable *chulha* uncoked second grade coal can be used for cooking purposes. Very little coal is used, as such, in India for cooking purposes, the reason being that the smoke of it contaminates and gives an unpleasant taste to the food. Smoke is not objected to so much in the air of the room. The use of coal for cooking purposes is to a large extent limited to employees on the coalfields, and the reason why it is used there is that it is given them free. Even then the coal is kindled long before the operation of cooking takes place, and is reduced to a glowing coke before the food is placed over it. The gaseous part of the coal is thus wasted. Sometimes employees of a Coal Company club together and coke the coal allowed, on a small scale and, needless to say, in a wasteful manner, and use the coke so produced in their *chulhas*.

The trouble with a new type of stove is the difficulty of persuading Indian villagers to buy it. Not only is there the usual intense conservatism—and perhaps religious partiality for a fuel which is the product of a sacred animal—but an intense dislike to spend even a few annas on a new article of, to them, problematical efficiency, requiring intelligence, thought and experience. It might pay the coal companies to present coal-burning *chulhas* or to sell them below cost price to families buying their coal. It might be worth while for Government to offer a prize for the improvement of a cheap *chulha* which would burn coal and cook rice, *chapattis* or curry without smoking them. It should not be a difficult problem. Some sort of chimney seems the most essential thing, and other possible lines of enquiry (on which Dr. Fox proposes to make a few simple experiments) are the briquetting of coal slack with some inert substance to reduce the rate of combustion and the use of a bellows to reduce the smoke to a minimum.

The difficulties in the case of coal burned as such do not appear insuperable, but the substitution of coke seems to me a much more promising remedy. The price of soft coke is usually about 50 per cent. greater, sometimes a little more, than that of coal, but, as Dr. Watson shows, heat for heat, the difference in price is small. Much of the second grade coal now being worked is worked because it is necessary to do so to get at the better-grade coal. In other cases the high grade coal of a seam is taken out, and the rest—often forming the bulk of the seam—is left behind in the ground; whether it will ever be taken out is a matter of price.

Dr. E. H. Pascoe.

Were an adequate market and a suitable price obtainable, there is little doubt that large quantities of soft coke—a fuel acceptable in nearly every way to the Indian villager could be placed upon the market and distributed by railways and ultimately by bullock carts assisted perhaps in some cases by steam-road lorries or motor lorries. Government could assist by improving the roads where necessary. There are in the Raniganj, Jharia and Bokaro coalfields thousands of millions of tons of second grade coal, much of which would yield a soft coke. The danger to the scheme lies in the absorption of profits by middlemen, and a maximum selling price would probably have to be fixed either by the coal companies in combination or by Government; in the latter case some sort of licensing system would perhaps be necessary.

The ideal medium for the distribution of coal would be canals. Unfortunately, navigation canals, on the whole, have met with indifferent success financially in India. Nevertheless, I think the question of tapping some of the large Damodar Valley Coalfields by canal is worth careful investigation. Barges thus brought down to the Ganges could be towed by tugs to the populous tracts of the Ganges Valley.

The whole question seems to depend upon the education of agriculturists to the value of cowdung cake and thus raising it nearer to its actual value. If this could be done, the substitution of coke or perhaps in some cases coal would, I think, follow as a matter of course. The question of bringing home to the agriculturists the value of cowdung cake is outside my scope. Really informative propaganda, by which I mean propanganda which not only tells the enquirer what he ought to do, but also why he ought to do it, is perhaps the most important line of action.

It might be worth while for Government to appoint a small committee to consider the whole matter, the committee to include an agriculturist, a geologist and an engineer, with powers to co-opt.

Oral Evidence.

A.919. *The Chairman*: Dr. Pascoe, you are in charge of the Geological Survey of India?—Yes.

A.920. You have provided the Commission with answers to certain questions in our Questionnaire and you are also, I think, responsible for the production of a memorandum on India's resources in mineral fertilisers, which memorandum was forwarded to us by the Central Government sometime ago. Have you any remarks of a general character which you wish to address to the Commission at this stage?—No. All I have to say I have put into my note in answer to the Questionnaire.

A.921. Your memorandum in answer to our Questionnaire is confined almost entirely to suggestions as to how Government or other agencies may assist in solving the problem of persuading the cultivator not to burn cowdung?—Yes.

A.922. You have provided us with certain facts and given references, the effect of which is to show that the actual calorific value of cowdung in relation to its value cannot be taken as sufficient reason for the practice of burning cowdung in place of coal?—Dr. Watson has proved that in a paper which has appeared in the *Indian Trade Journal*.

A.923. But you point out that apart from custom there is in this connection the matter of convenience in that the fuel is not burned in a fire-place with a chimney, but it is very often burned in the open house in a *chultha*?—Yes.

A.924. Dried cowdung gives a slow smouldering fire which, I suppose, is ideal for certain practices of cooking; is it not?—I suppose so.

A.925. Do you not think the difficulty of getting a fuel other than cowdung which gives a steady heat for long periods without any flame or smoke is one of the principal reasons why cultivators insist upon using cowdung?—Yes, that is the principal difficulty. When villagers use coal they let it burn outside until they have a glowing smokeless fire, which they then take into the house and use for cooking purposes.

A.926. And it goes on glowing for a very long time?—Yes, until the coke is exhausted.

A.927. Without any chimney?—I believe so.

A.928. Do you suggest that there are any practical steps in the way of promoting the wider distribution and cheaper production of coal that Government might take which might be expected to lead to a substantial reduction in the amount of cowdung burnt?—I cannot suggest any action that Government could take. It seems to me the main point is to bring home to the cultivator the value of cowdung, and by raising its price enable coal or coke to compete with it.

A.929. I want to turn for a moment to the note on fertilisers to which I made a reference. You give there full information about all that has been done in the way of a survey of those various products and natural deposits. Do you think that that survey is complete, or do you think that other deposits ought to be discovered or made available?—Do you refer to any particular deposits?

A.930. No. Let us take them one by one. What about rock phosphates?—I do not think there is any likelihood of any extensive deposits being found. I have a staff of only 30 to deal with the whole of India, and one cannot cover very much ground during the year with such a small staff. But there is no likelihood of large deposits being found.

A.931. I take it nitrate of potash deposits in old towns and villages may exist almost to an unlimited extent?—The extent to which they exist is unknown.

A.932. What about limestone? Is that a substance which exists in India?—That is a universal product that could be obtained anywhere in India. There is no lack of limestone in the country except in particular districts.

Dr. E. H. Pascoe.

A.933. And gypsum?—Gypsum is fairly universal; there is not very much in Madras and the Central Provinces, but in the Punjab, and Burma there are large quantities of it.

A.934. What is your method? Are you carrying out a further survey in detail throughout the country?—Yes; we have parties working in each Province and we also undertake enquiries regarding any special problem that crops up, the testing of dam-sites for instance and questions of that nature.

A.935. You are gradually building up a more detailed and complete survey than that which exists at the moment?—Yes. All our information is published as soon as available.

A.936. What about the Indian States?—We have in the past done a good deal of work in the Indian States, but according to a recent order Indian States are now asked to pay for such surveys, so that they sometimes refuse to have them.

A.937. Is it your view that there may be important deposits of mineral fertiliser in Indian States which have not yet been discovered?—No.

A.938. How far do your responsibilities go? Merely the discovery and recording of those matters, I take it?—Yes.

A.939. Are you concerned at all about advising anybody about the technical methods of extraction?—We help as much as possible, but we take responsibility for nothing of that sort.

A.940. Nor, I take it, do you interest yourself in the geographical position of those deposits in relation to areas where soil deficiencies exist in the neighbourhood?—No; we have not taken up that side of the work.

A.941. That is important in relation to the heavy charge for transport?—Yes.

A.942. *Sir Ganga Ram*: Does the official note* contain an account of the deposits in the Indian States?—It has reference to British India mainly; if we had any information regarding Indian States it would be mentioned there.

A.943. *Professor Gangulee*: With regard to phosphatic manure for this country, you are definitely of opinion that we cannot look to rock phosphates for the supply of that manure?—Yes.

A.944. What about Trichy nodules?—They have been examined. We have no information as to quantity because it is difficult to estimate; they occur in lenticular patches and one cannot very well measure them.

A.945. So, we will have to depend on bonemeal for phosphatic supply?—Yes.

A.946. You are definitely of the opinion that that is the only source that India can take to?—We can supplement that with a certain amount of phosphates.

A.947. Not to any great extent?—No.

A.948. As regards second grade coal, have any experiments been done with regard to its calorific value?—Yes; there are figures regarding different qualities of coal.

A.949. What about quantity?—An estimate was made by Sir Henry Hayden 4 or 5 years ago, and his figure was 78,000 million tons of coal in the country. I suppose out of that about 75,000 million tons would be second class coal. That estimate was based on mining only to a depth of between 500 and 1,000 feet; if you went to 2,000 feet you might say there are 150,000 million tons.

A.950. Do you consider that that presents a hopeful field for the expansion of fuel supply?—The amount of coal available may, for practical purposes, be regarded as limitless.

A.951. *Mr. Calvert*: Do you think there is a large field for the use of coal dust and charcoal dust for village fuel?—Do you mean first class coal or second class coal?

* Not reprinted: Note on India's Resources in Mineral Fertilisers in memoranda prepared by the Government of India for the Commission.

A.952. Dust coal and dust charcoal, which is wasted?—With dust coal you will still get the smoke. With wood charcoal you do away with the smoke difficulty.

A.953. From coal you get smoke?—Yes; with coal you will get the smoke unless it is burnt to coke first.

A.954. But charcoal is free from that?—You mean wood charcoal?

A.955. Yes?—Yes.

A.956. Have you any experience of charcoal briquetting?—No; it does not come within my sphere.

A.957. *Mr. Kamat*: At present a lot of minerals is exported from this country in a raw state. Have you considered the advisability of turning them into finished products in this country, so as to give occupation to the people?—Yes, Government are always willing to take any measure to encourage the manufacture of finished articles from the raw products.

A.958. Is literature available in your department if private enterprise comes forward to do it?—Yes.

A.959. *Rai Bahadur Bannerji*: You have suggested in this note of yours that if the value of the use of cowdung as a manure is taught to the people and they are given a cheaper fuel, perhaps a time will come when cowdung will be used mostly as manure. And you are also of opinion that enquiry should be made into the possibility of briquetting of coal slack with some inert substance to reduce the rate of combustion and the use of bellows to reduce the smoke to a minimum. Any experiment on briquetting coal dust should be conducted on second class coal. Is any experiment being made in our country in that line?—None that I know of.

A.960. Have experiments been made in England and other countries on briquetting of second class coal dust?—A mixture of clay and second class coal has, I believe, been used with a certain amount of success.

A.960a. And it had a certain amount of commercial success?—That I cannot say, but it does minimise the smoke.

A.961. That experiment is not being made now, and it will be sometime before it is taken up by anybody here. The people of India do not commonly care for the smoke, they even use steam coal. But generally they burn soft coke which has less smoke after it is rendered red hot (*pora* coal as it is called in Bengali). If the coal-owners manufacture a larger quantity of this soft coke, do you not think it will be in a position to replace cowdung altogether?—Yes; that is my suggestion.

A.962. How would you induce a large sale of this soft coke among the people in the interior of the country?—Raise the price of cowdung cake, and if possible lower the price of the coke.

A.963. Lowering of the price of coke has been done in two ways, first, by the owners reducing the price and, secondly, the carrying railways reducing their freight. Would you advocate a reduction of railway freight on soft coke by Government interference?—It is a question which I hardly feel competent to answer; it is not a geological question.

A.964. The Indian Mining Federation, the members of which deal with second class coal generally and most of whom have collieries in the Jharia fields which is coking coal, have approached Government with the request that the railway freight for soft coke should be reduced by 50 per cent, so that they may offer soft coke for fuel purposes. Do you advocate it?—It would certainly have the effect of reducing the price of soft coke, but I cannot say that I am keen on Government interference in things of that kind, from a general point of view.

A.965. What the Government will do is neither my lookout nor yours. If soft coke will be within the easy reach of the common masses, they may be induced to give up burning cowdung for fuel?—If we reduce it by 50 per cent I should say yes.

A.966. *Sir Ganga Ram*: Is there a central laboratory to make experiments on manures to be made out of these natural deposits?—I have a laboratory

in my office in which we carry out simple experiments of that sort, and the Government Test House at Alipore carries out experiments on coal.

A.967. Experiments on natural deposits which can be turned into manure? Supposing I send you a natural deposit, would your laboratory give any results?—We could analyse it for you and tell you what it consists of.

A.968. Could you say by what process it can be made into manure?—Yes.

A.969. *Sir Thomas Middleton*: Has the Geological Survey carried out any special surveys of Government experimental farms?—No.

A.970. Has the Survey published any papers on the subject of the relation of soil to rock formation?—The only paper of that sort which I recollect is the paper by Center on *reh*. It is a very old paper.

A.971. At the present time, are your survey parties exclusively engaged in the mineral areas?—No, we have survey parties doing purely scientific work.

A.972. On what scale do they map?—On the largest scale for which we can get topographical maps.

A.973. 6 inch maps?—6 inch maps are not available in this country.

A.974. What do you get to work upon?—One inch maps.

A.975. *Sir Ganga Ram*: Are those maps for sale?—They are for sale by the Survey of India.

A.976. *Sir Thomas Middleton*: Are the Geological maps published?—They are published in our publications with the reports.

A.977. They are not issued separately for sale?—No.

A.978. Have you any general geological maps of Provinces on a scale of about 25 miles to the inch?—We have a map on the scale of 32 miles to the inch, which we are now revising.

A.979. Published for All-India?—It has never been printed yet; it is all coloured by hand, but the new edition we are going to have printed off in colour.

A.980. What is available to the public at the present time?—Various maps which appear in connection with memoirs.

A.981. *Dr. Hyder*: Your paper is based on the paper contributed by Dr. Watson?—Yes.

A.982. What would be the manurial value of a maund of cowdung? At present, if cowdung is used as manure, what would be its value in rupees?—I understood it would be about $11\frac{1}{2}$ annas a maund.

A.983. That was in the year 1908?—Yes.

A.984. You do not possess the figures for the present year?—I have been trying to get them.

A.985. According to Dr. Watson's paper, its manurial value would be 11 annas per maund, and when it is used as fuel its value is 4 annas?—As fuel its value is $4\frac{1}{2}$ annas.

A.986. So, this country loses, on every maund of cowdung burnt as fuel, about 7 annas?—Yes.

A.987. That is the net loss to agriculture?—Ycs.

(The witness withdrew.)

The Commission then adjourned till 9-30 A.M. on Wednesday, the 8th December, 1926. For proceedings of meetings of 8th December 1926, and 5th to 7th January 1927, see Volume IV, and for 13th to 19th December 1926, see Volume V.

Monday, January 10th, 1927.

PUSA.

PRESENT :

The MARQUESS OF LINLITHGOW, D.L. (*Chairman*).

Sir HENRY STAVELEY LAWRENCE,
K.C.S.I., I.C.S.
Sir THOMAS MIDDLETON, K.B.E.,
C.B.
Rai Bahadur Sir GANGA RAM, Kt.,
C.I.E., M.V.O.
Sir JAMES MACKENNA, Kt., C.I.E.,
I.C.S.

Mr. H. CALVERT, C.I.E., I.C.S.
Professor N. GANGULEE.
Dr. L. K. HYDER.
Mr. B. S. KAMAT.

Mr. J. A. MADAN, I.C.S.
Mr. F. W. H. SMITH.

} (*Joint Secretaries*.)

Mr. G. S. HENDERSON, N.D.A., N.D.D., Imperial Agriculturist,
Pusa.

Replies to the Questionnaire.

QUESTION 1.—RESEARCH.—(a) (i) and (ii) I have dealt with this at large under Question 4, Administration. Veterinary work should be an essential part of any development in Agriculture.

(b) and (c) The Agricultural Departments have so far merely touched the fringe of the possible problems for investigation and research. It is my opinion that the first step should be that of setting the administration in order and an orderly survey made of the means available for an organised attack on the present terrible state of agriculture and livestock in India.

Some crops have had more attention than others, but there are crops such as potatoes of great importance which have had little attention. The whole question of grading of export crops needs thorough investigation, probably drastic legislative action will be required to raise the standard of Indian agricultural exports. This has been found necessary in other countries. An example may be quoted of Canada regarding wheat and Australia regarding dairy produce. The whole field of agriculture and livestock in India is in the greatest need of investigation and research. It hardly seems possible to name any lines of work which would not directly or indirectly give most valuable results, if properly prosecuted. The great dangers of course are misdirected effort, waste and extravagance, and in my opinion the real duty of the Central Government is to direct effort and public opinion along proper lines. Money is always available for the prosecution of research either from the trade or from the public interested. It would be a thousand pities to see a number of different agencies all working independently and not using their energies in the best possible manner. India is certainly coming within sight of such a state owing to the number of independent bureaux and committees which are being established simply because there is no central body strong enough to take them all into its fold.

Mr. G. S. Henderson.

QUESTION 4.—ADMINISTRATION. In my opinion the stage has now been reached in the history of the Agricultural Departments of India at which the greatest necessity is a thorough revision and reorganisation of the existing administrative system.

The most outstanding feature of the growth of these departments in India is that their expansion has been extremely unequal. The original plan was that a staff of experts with a central teaching institution should be provided for each of the Provinces in India. In some cases the Provinces began with some sort of agricultural organisation and so got a good start. An examination of the present budget of the various Provinces reveals this startling difference and this difference appears to be steadily increasing year by year. On one hand we have the Punjab spending Rs. 14,00,886 in 1924-25 and on the other side Assam spending Rs. 2,72,768 and Bihar and Orissa spending Rs. 4,81,629. This means that different parts of India are being catered for in very different degrees. Other factors which complicate the situation are :—first, the Provinces have purely political boundaries; in some cases they are less homogeneous than is the continent of Europe; also homogeneous tracts spread through two or three Provinces. The second important factor is that there is a large area under Indian States which in many cases are practically independent.

If the present state of affairs continues, some of the Provinces will have a very large organisation and will completely overshadow not only the other Provinces but also the agricultural machinery of the Central Government.

The original idea of the Central Agricultural Department at Pusa was a body of scientific experts divided into the following sections :—

1. Chemical section,
2. Agricultural section,
3. Mycological section,
4. Bacteriological section,
5. Botanical section,
6. Entomological section.

The Heads of these Sections were presumed to be experts of such standing that they carried weight in their branch of agricultural science throughout India. They were situated at Pusa as a convenient centre or more probably from motives of economy as the Pusa Estate was lying vacant. The Director of Pusa was the co-ordinating Head and the department as a whole was represented by the Inspector General of Agriculture who kept in touch with the Central Government and by means of extensive touring, was acquainted with conditions in all Provinces. His advice was in request by the young departments. This post was then abolished and the Director of Pusa and Agricultural Adviser to the Government of India were vested in the one incumbent.

In my opinion the time has now arrived for a thorough consideration of this situation. It seems to me that the Department of Agriculture under the Central Government has been too closely associated with Pusa. The name Pusa and the Central Agricultural Department are almost synonymous. The only exception follows on the creation of the Section of Dairying situated at Bangalore. Hand in hand with the extension which has taken place in some of the Provinces, there should have been expansion and extension not so much of Pusa, as of the Sections. Some of the Sections should have expanded and established centres in other parts of India if anything like the original proportion was to have been maintained.

The present situation is further complicated by the establishment of various central committees and bureaux dealing with special crops, such as the Central Cotton Committee and the Sugar Bureau. There is a branch of the Central Cotton Committee concerned with cotton work situated at Indore. The Head of this establishment is called the Agricultural Adviser to the Indian States and Director Plant Breeding Institute, Indore, and is under a practically independent committee.

The political aspect under the new conditions following the Reform Scheme is all important. Where the Directors of Agriculture are in touch with current political affairs, there is a much greater likelihood of getting the requisite financial support and machinery for expansion. In some Provinces the Director is a member of the Legislative Council, in other cases, he deals with the Minister concerned, chiefly through permanent secretaries and under-secretaries. Difficulties may be caused by the situation of headquarters and other factors. These factors have a large bearing on the success of a department. In the Central Government the Head of the Agricultural Department has to be frequently present with the Government in Simla and Delhi while his main headquarters is at Pusa and he has to do heavy touring to keep in touch with all the Provinces in India.

We can now consider what the situation would be in the event of the large extensions which are foreshadowed in some of the Provinces being given effect to. It would be possible to carry on as at present with Pusa as the headquarters of a body of scientific experts comprising the advisory staff attached to the Agricultural Adviser to the Government of India. In this case, the general tendency undoubtedly would be for Pusa to turn into a very centralised body having less and less connection with current agricultural affairs in India, as the development of the Provincial Agricultural Department increased.

The retention of the present Board of Agriculture or even an enlarged body in its place would do little to help matters.

The chief criticism of this state of affairs would be that practically all initiative would pass from the Government of India in agricultural affairs. It would be very difficult to see how problems which affect two or more Provinces could be properly taken in hand. Questions affecting trade, export crops and large Indian States would probably remain in abeyance. The Government of India is responsible for questions of a national character in India and it does not seem these can be suitably solved by handing over the direction of affairs to be dealt with piecemeal by provincial departments. We have heard the cry from a Provincial Director of Agriculture, "We want no interference from Pusa"; by this is meant the Central Department of Agriculture, but it is hardly likely that the Government of India would ever interfere even in the remotest way with any purely domestic question in a Province.

The simplest and most logical method of expansion for the Central Agricultural Department might have begun about the time when owing to the growth of the provincial departments, it was found expedient to replace the Covenanted Civil Service Directors by members of the Agricultural Service. At this time the Heads of the sections at Pusa should have been raised to at least the grade of Directors of Agriculture and made responsible for the activities of their sections throughout India. If this had been done, a thoroughly sound nucleus would have been available for eventually building up a business-like department on sound lines. No action of this nature was taken with the inevitable result that work at Pusa tends to become more and more divorced from that being done in the Provinces. Senior members of the Agricultural Service fight shy of any of the Pusa posts largely because it is realised that coming to Pusa means their chances of promotion in their own Provinces are very greatly lessened and also because advantages of proportionate pension are not given to members of the Central Agricultural Department though they are members of an All-India Service.

One effect of the Reform Scheme is a considerable tightening up of financial control. Audit inspections are much more rigid, and in a subject like experimental agriculture, the ordinary audit principles suited for the large routine establishments of the Government of India are totally inapplicable. The result is a considerable amount of interference, loss of time and diversion of staff from proper work to explain elementary facts to the audit officers. As an example of this, some of the members of the Agricultural Section had to be diverted from their research work to try to explain to the audit staff such questions as the following :—

1. Why self-binders and reaping machines lie idle most part of the year?

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2. Why some cows calved every year while some only calve once in two years?

3. Why is it not possible to purchase stores in the cheaper season to avoid loss due to a rise in the market? These are a few examples from the report of about 80 pages of objections.

As the financial hold increases, the general tendency will be to hold the Director of Pusa personally responsible for all the work and gradually decrease the limited powers and initiative originally vested in Heads of Sections. In my opinion it is this fact that lies at the bottom of much of the criticism raised against Pusa.

The Government of India must have a strong central executive body to co-ordinate and to advise on all questions of agricultural nature in India. They must have the machinery for keeping in intimate touch with provincial agricultural affairs. Some Provinces seem to think that any central authority should merely be of an advisory nature, but such is hardly possible. There are innumerable difficulties. In the stress of political conflict, the authority of such a body would probably be null and void.

Such central executive authority has been found necessary in all parts of the world and a very good model for India to copy would be the Central Department in the United States of America. The Head of the department must be a member or have a representative in the Assembly. He should rank as a Secretary to Government. As it is a physical impossibility for any one man to tour India sufficiently intensely to be thoroughly informed about local conditions, three or four experienced agricultural officers are needed to keep the central authority in touch with the provincial authorities. It would be necessary to take an officer for each division with considerable experience in that class of agriculture, *e.g.*, a man who has done his ten to fifteen years in the Madras Agricultural Department would command weight as a representative for South India and so on. The machinery would be built up as funds and facilities are available for the establishment of branches or divisions, one for each staple crop, one for each of the present Sections of Pusa if needed, one for agricultural machinery implements, one for irrigation, one for livestock and dairying, one for trade questions dealing with the grading and quality of India's export crops; manures would also have to receive attention. Other divisions required would be publicity, meteorology, education, statistics and publications, and liaison machinery for co-ordinating with the Irrigation Department, Forest Department and the Veterinary Department, etc.

A mass of details would have to be carefully considered, but unless some plan on the above lines can be evolved, it is difficult to see how the future Government agricultural work and its allied branches can avoid falling into a chaotic state. There is no reason why in the event of some such organisation being established, the relation between it and the Provincial Agricultural Departments should not be perfectly harmonious. One of the disadvantages of provincial rule is the water-tight compartments into which various tracts of similar agricultural areas are divided. The Central Department might avoid overlapping and would obtain much quicker development by arranging working agreements in the case where neighbouring Provinces have homogeneous tracts or where they are working on one problem under similar conditions. To take two concrete instances, Sind and the South Punjab, secondly Eastern United Provinces, North Bihar, North-West Bengal; these are cases in point of homogeneous tracts running through several Provinces which could very easily be grouped together.

If the above scheme is contrary to the Government of India Act and the Devolution Rules, I still think that before any form of body composed of Directors of Agriculture is formed, the Central framework must be considerably strengthened and the Head of the department put on a higher plane than is the case at present.

(c) (ii) *Railways and Steamers*.—The present situation in India with regard to freight haulage especially small parcels less than a truck load can only be

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described as very bad. In long distance hauls especially where there is a break of gauge, the situation is extremely bad. There is invariable delay.

(iii) *Roads*.—In some districts such as Sind, roads are practically non-existent and camels are the only practical means of transport. Much could be done if funds were available.

(iv) *Meteorological Department*.—I am of the opinion that closer co-operation with this department and the Agricultural Department is required. It is more a provincial matter however than a central one.

QUESTION 8.—*IRRIGATION*.—The extension of irrigation by surface water from rivers, etc., and the utilisation of the underground water are both of vital importance.

Sind is an example of a country in which cultivation is practically impossible without irrigation. In other parts of India wells are of more importance. They generally extend the season of cultivation or help out a deficient monsoon.

The importance of well irrigation can be seen by the fact that some 16,000,000 acres are commanded by wells. The difficulties in the way of expansion both of wells as well as of large canal projects are chiefly those connected with finance. The questions asked under this head refer to districts and any general answers would be of no avail.

QUESTION 9.—*SOILS*.—(a) (i) Under this head I would instance a method on new lines which has been adopted for improving waste lands at Pusa which are subject to heavy flooding in the monsoon. There are considerable areas of this class of land in North-East India where large rivers coming from the hills are headed up by the Ganges in flood and considerable areas are periodically flooded. In the case of Pusa, the land was of a coarse sandy nature and grew rough grass and jungle practically unsuited for any economic purpose. After flooding, the land dried very rapidly and cropping was too precarious to render it practical. Some four years back about 180 acres of this land was gradually levelled as farm bullocks were available and irrigation pumps were provided at convenient spots along the river. When the land was fit to plough after the floods had abated, *berseem* or Egyptian clover was sown. This gave several grazings until the hot weather started. Thereupon maize was sown which was gradually cut for fodder until the rise of the river prevented further work. No attempt was made to keep the land from being flooded. It has been found that this system works very well combined with a dairy herd of cattle. Green fodder is provided at a critical part of the year.

(ii) *Reclamation of alkali land*.—I had experience in this class of work before coming to India in a large reclamation work at Lake Aboukir in North Egypt. I did some work on these lines in Sind at Dowlatpur and at Sukkur. I am a member of the standing committee of the Harappa Bara Reclamation Farm in the Punjab. I submit a copy of the bulletin* on this subject.

(b) (i) Where leguminous crops have been cultivated and grazed with cattle, a very marked improvement on the soil has resulted in every case.

(ii) Examples of deteriorated soil can be found on any large irrigation canal, especially near the main channel owing to seepage and percolation.

(c) This is a matter for local settlement in each case and no general rules could be laid down.

QUESTION 10.—*FERTILISERS*.—(a) Fertilisers could be used profitably to a much greater extent than they are at present on all capitalists crops and garden crops.

(b) I do not think there is at present any extensive fraudulent adulteration of fertilisers.

(c) It is a matter for district propaganda work for the usual methods in each district.

(d) North Bihar for sugarcane.

(e) Investigation on the effects of manuring is required in every area. It is a matter which requires very much further extended investigation.

*Not printed.

(f) I think that far too much fuss has been made over the practice of using cowdung as fuel. I think it is a question which might well be left alone.

QUESTION 11.—CROPS.—(a) (i) The ideal method of dealing with the question of the improvement of an existing crop in an area is, first of all, a survey by a qualified botanist possibly helped by an experienced agriculturist, then botanical work at headquarters followed by the establishment if necessary of seed farm and demonstration plots. Where such procedure is not possible a great deal can be done for the improvement of existing crops by every agricultural station. Pure line selection can be done by every agriculturist of the staple crops with which he is working. It should be strictly laid down that this is an essential part of the duty of every station dealing with crops in India. Agricultural selection has been going on in the Pusa Farm for a considerable time and the special selections which are now being grown will be shown to the Commission.

(ii) One of the best examples of a new fodder crop is the introduction of *berseem* (*Trifolium Alexandrinum*). This had been tried on small plot scale only in India previous to 1907. Suitable seed from the alkali lands of North Egypt was introduced into Sind during the following years and this valuable fodder crop is now found from the North-West Frontier Province to South India. It is an irrigated white clover and gives a heavy yield of succulent fodder from November to April-May where irrigation is available. It is a most valuable rotation crop and produces fodder abundantly during the critical months before the break of the monsoon.

(iii) and (iv) are local questions.

(b) In many cases it is quite possible to substitute a heavier yielding food crop, but before this can be done with safety, local conditions must be thoroughly investigated. In most districts there is cast-iron custom as to the staple food grain, and if another grain is grown it may be found that there is no demand for the new grain. For example, in a *juar* eating tract, *bajri* will not be eaten. So also a heavy yielding rice may be entirely unsuited for the consumption of a particular tract.

(c) Three of the most successful efforts of improving or substituting more profitable crops are in my opinion the following:—1. American cotton in the Western Punjab; 2. Coimbatore canes in North Bihar; 3. Pusa wheat all over India.

QUESTION 12.—CULTIVATION.—(i) This is a local matter.

(ii) In all rotations more importance should be given to leguminous fodder crops especially in irrigated land and the possibility of grazing of these crops by cattle should be considered.

QUESTION 13.—CROP PROTECTION.—I am of the opinion that present measures are suitable provided that provision can be made for immediate expansion under circumstances of necessity.

QUESTION 14.—IMPLEMENTS.—The question of the smaller agricultural implements is a domestic one as the requirements, say in the case of ploughs, vary according to the district, nature of land and other factors. There are several Indian manufacturers of ploughs, etc., and they have sold considerable quantities of cheap ploughs modelled on samples imported from abroad. The copies are quite good though somewhat roughly finished, but they are wanting in the fact that the plough bodies and shares are made of a poor class of metal which quickly wears out. For plough shares a high carbon content steel is required if the plough is to last for any length of time. The local manufacturers in India should be encouraged to use a better class of material.

The larger and costly agricultural machines suitable for special circumstances and large landowners, etc., are more a matter for the Central Government. There are a number of difficulties to the spread of such implements and machinery. In some cases, the proper type of machine has not yet been evolved. In my opinion when agricultural machinery of a type suited for a

particular purpose has been proved successful, there will be no difficulty in getting it taken up as a commercial proposition. Such machinery is not likely to be manufactured in India in the near future. It is very specialised work and there must be possibilities of large sales before any manufacturing engineering firm will evolve a new type. In the past there has been many failures, as the actual manufacturing firms are not in touch with local conditions. They usually employ agents at the big ports, that is Bombay and Calcutta, and these agents also are frequently not in touch with local conditions. They carry as a rule a very limited stock of spare parts and they are chiefly concerned in getting a cash sale without having any particular care as to whether the machine is suitable or not. A very important problem at the present moment is the production of a suitable threshing machine. There is nothing at present in the market which actually is suitable for conditions in the wheat tracts of North-West India. I have been working on this problem a number of years in conjunction with several implement manufacturers in Great Britain, but I have not been provided with sufficient means to make any great progress. An attempt was made in the year 1919 to get the Society of Motor Traders and Manufacturers to hold agricultural tractor demonstrations in India. This would have been of great value in bringing out to India actual manufacturers of agricultural machinery who could have seen the market possibilities at first hand. An example of the extended use in India without any Government action or propaganda work is that of the almost universal use of rice-hulling machinery. All conditions seem to me favourable for rapid and extensive use of harvesting and threshing machinery for the large wheat areas, provided the proper type of machine is available. India is one of the few large wheat growing countries where the grain is cut by hand and threshed with bullocks.

As a prime mover the steam engine is possibly most suitable to India than small internal combustion engines. This applies to agricultural tractors.

QUESTION 16.—ANIMAL HUSBANDRY.—(a) The methods for improving live-stock depend largely on suitable financial equipment. Work so far has merely touched the fringe of the subject. There is necessity of central co-ordination as well as prosecution of the work already started by various Provincial Governments. The whole subject was pretty thoroughly gone into during the last Board of Agriculture at Pusa by a special Livestock Committee and I heartily supported the resolutions come to at that time; copy* is submitted.

(b) The questions are chiefly of local significance.

(c) The period of extreme scarcity over the majority of India is at the end of the cold weather and up to the break of the monsoon. Cattle which survive are so emaciated that when the flush of grass comes on with the first rainfall, there is very considerable loss owing to digestive troubles.

(d) It is possible in many cases to grow fodder crops and where irrigation is feasible, leguminous fodder crops should be in all rotations. Silage in pits and the storage of grass and *kadbi* would be encouraged by all means.

QUESTION 17.—AGRICULTURAL INDUSTRIES.—(a) This all depends on a number of local circumstances, the period during which bullocks are worked will be lengthened if the cultivator does carting work or uses bullocks for water lifting. The actual working days in Sind might amount to 100 or 120.

(b) and (d) I am not in favour of Government intervention.

(c) and (e) to (h) I have no suggestions on (c) (e), (f), (g), and (h), except the fact that there is always far more employment in Sind than there are labourers available and the same applies to Bihar. As long as this is the case, I see no reason for encouraging subsidiary industries.

QUESTION 18.—AGRICULTURAL LABOUR.—The measures to attract agricultural labour must vary in every district and no useful general rule can be laid down. It is not possible in all cases to bring labour from some tracts to others. For example, attempts to attract labour from Gujarat into Sind have been a failure in every case. The colonists either die or quickly

*Not printed: *vide* Proc. Bd. Agr. in India held at Pusa in 1925.

leave the country. Punjabi colonists can live in Sind and immigrants from the desert country of Rajputana come to Sind each season especially in years of scarce rainfall, but they generally depart after staying only a short time with what wages they have accumulated.

QUESTION 19.—FORESTS.—The questions under this head are largely local, but in one case the destruction of forests on upland country which occurred gradually in Chota-Nagpur has not only led to soil erosion but the whole climate has altered. Early rainfall used to be frequent from April until the break of the monsoon. Instead, severe hot weather is found at this period so much so that it is not possible to plant out young tea bushes. So no tea gardens are now made in this area though there are several productive old gardens.

QUESTION 20.—MARKETING.—(a) to (c) I will confine my remarks to the question of wheat exported from India. This contains a large percentage of dirt; it also contains foreign grains such as barley, mustard and rape, it contains a mixture of soft white, medium white and hard red wheat all of which would obtain better prices if sold pure. Wheat is exported in bags and this necessitates very expensive handling, extra railway stock and huge dock areas as the bags have to be stored on raised plinths. The whole system is primitive and out-of-date. The trade interested however does not recommend any change and a thorough inquiry is necessary and very drastic action on the part of the Central Government.

(d) The method of posting market prices at the various markets as done in the Punjab for cotton and wheat seems to be a very sound piece of work.

QUESTION 24.—ATTRACTING CAPITAL.—(a) As a general rule, capital fights shy of agriculture in India though there is plenty of money available for special crops in approved districts such as tea. In order to get men of capital and enterprise to actually take up general agriculture, a change of attitude would be necessary on the part of those Provinces which have land to dispose of. At present no encouragement is given to outsiders. This policy is probably quite sound for political reasons.

(b) Owners of agricultural lands under the Permanent Settlement have little or nothing to do with the actual working of their property. They are practically nothing but tax gatherers. In other parts of the country, owners generally let their lands and it is very seldom that owners are found who actually cultivate their own land. A certain amount of good might be done if Government were to include in the Honours List rewards for cases of enlightened management and well conducted farming.

QUESTION 26.—STATISTICS.—Most of the statistics is dependent on the returns submitted by the lowest revenue official. In Sind this is the *Tapedar*. He is able to write his returns in the vernacular and is a very poorly paid man without any interest in the figures which he produces. Until a better medium is provided for the production of statistical material, I fail to see how any improvement or further complicated methods at headquarters will improve the situation. I inspected a case personally in Sind as to the returns about cotton cultivation and outturn. These figures remained constant year after year though it was obvious that there were large differences both in yield and in area grown. The actual figures of production were obtained from the cotton gins for comparison. It was found that the *Tapedar* usually put down 8 annas as a safe figure for his returns.

Oral Evidence.

A.988. *The Chairman*: Mr. Henderson, you are Imperial Agriculturist?—Yes.

A.989. You have provided the Commission with a note of the evidence that you wish to give. Do you want to say anything in amplification of that note before I ask you some questions?—No. I think it expresses all my views quite fully.

A.990. Would you give the Commission a short account of your own training and past appointments?—I have been connected with agriculture all my life. My father was a land agent and I was trained in the West of Scotland Agricultural College. I was assistant to Sir Patrick Wright for two years; I was in Canada for some time. I then went to Egypt as an assistant in a land reclamation company. From Egypt I got an appointment in the Indian Agricultural Service and was stationed in Sind for about 10 years. From Sind I was appointed Imperial Agriculturist at Pusa. I was on the Cotton Committee for a year and then I was sent to Mesopotamia as a Special Commissioner along with Sir Thomas Ward, who was head of the Irrigation Department. From there I was put on special duty on the Indian Munitions Board. After that I went back to my substantive appointment and was on deputation in England for several months to organise motor tractor trials in India. Since that date I have been stationed in Pusa.

A.991. Would you tell the Commission whether you think Pusa a suitable site for this Institution?—I consider it should be one of several sites; I do not think the Institution or the Imperial Department of Agriculture should be confined to any one site.

A.992. If this scheme of instituting several stations at various places were carried into effect, would you suggest that one of those stations should be a headquarters?—I think possibly it would be better to have headquarters in touch with the Government of India and not necessarily at a station.

A.993. How about post-graduate training; that would have to be concentrated at one station or another, would it not?—I think the ideal form of training would be to have a certain time at several stations.

A.994. Upon the assumption that only one station is to exist, what do you say about the suitability of the site at Pusa?—It is not a good site.

A.995. Why?—It is hopelessly out of touch with the rest of India.

A.996. It is difficult of access?—Extremely.

A.997. Would you attach importance in the choice of a site to its accessibility to visitors coming to India as well as to persons resident in India?—I think that is a most important point.

A.998. *Sir Henry Lawrence*: Do you say it is a most important or the most important?—A most important point.

A.999. *The Chairman*: Then you look forward, I gather, to a day when the institutions carrying on research and responsible for demonstration in India will be in far closer touch with like institutions the world over?—Yes.

A.1000. *Professor Gangulee*: Do you think that difficulty of inaccessibility can be overcome?—If railway facilities were improved or a bridge built across the river, it would be greatly improved.

A.1001. *Sir Henry Lawrence*: Or aeroplanes?—Yes.

A.1002. *The Chairman*: What exactly is the extent of your personal responsibilities?—I am primarily in charge of the farm and the cultivation of the whole of the area except some small pieces which are in charge of the various Sections. I am called upon to advise on purely agricultural subjects practically all over India.

A.1003. Are you ever called upon to advise upon problems of propaganda and demonstration?—I have done.

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A.1004. Are you responsible also for keeping the records of experiments carried on on the farm?—Yes.

A.1005. Men come and go, and it is very important, is it not, that records should be both accurately kept and readily available?—It is most important.

A.1006. Are you satisfied with the system of recording experiences?—I think the staff is not quite adequate.

A.1007. Is the system sound?—I think the system is quite sound.

A.1008. Do you depend to a great extent upon articles in agricultural journals as records of events, or do you record matters on some definite system of filing or indexing?—Articles in journals as a rule are merely abstracts or summaries; they do not give elaborate series of figures; the figures on which results are based are kept in the office.

A.1009. Do you find that you are able to turn up facts that are required expeditiously?—Yes, we have no difficulty about that.

A.1010. Turning to the note of your evidence on the first page you say it is your opinion that the first step towards progress should be that of setting the administration in order and that an orderly survey should be made of the means available for an organised attack. What exactly do you include there by the word "means"?—All existing agencies.

A.1011. I wondered whether you were thinking of finance as well?—And finance.

A.1012. Have you any suggestion to make as to how money might be provided for a campaign of this sort?—I should think the first step would be to bring the necessity of it to the attention of the public and specially to sections of the public; for instance, a trade problem, if it were properly represented, would in many cases get very ample support from the trades interested.

A.1013. Do you think the public, whether through corporations or by private subscriptions from private individuals, might make an important contribution to the funds required?—I think they would.

A.1014. I see you attach importance to the question of grading of export crops and you suggest that drastic legislation may be required to raise the standard of Indian agricultural exports. Do you think the time has come for an attempt to fix what I may call All-India standards for exports?—I think it is high time.

A.1015. That would mean action of a disciplinary nature at the ports probably, would it not, judging by the experience of other countries?—It would probably have to go further back. In some cases the crop would have to be dealt with before it came to the port.

A.1016. So that the action required to improve the quality has got to be taken at a stage far removed from the port?—Not necessarily, because in the case of cotton a certain amount has got to be done at the gin which, in every case, is really the nearest point to the cultivator.

A.1017. On page 124 you say, "It would be a thousand pities to see a number of different agencies all working independently and not using their energies in the best possible manner." Do you envisage the possibility of combining all the existing agencies under one supervising head?—I would not go so far as that but I should certainly think there ought to be much more co-ordination.

A.1018. Take the Indian Central Cotton Committee. What do you think of that organisation?—I think it is a very sound thing. I was responsible for the drafting out in the first instance.

A.1019. Do not let modesty stay your hand. Tell us if you are satisfied with your work now that you see it in being?—I think it is rather apt to go too far. I think when it was originally established it was the only possible means of carrying out a certain object; but I think, however, that it is only in the nature of a temporary measure.

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A.1020. What makes you think that?—If the Indian Central Cotton Committee expands as it is doing just now and gets in a staff, that staff might be working without any co-ordination with other agricultural workers even in the same Province. You might have a Cotton Botanist working on cotton and quite close you might have a Wheat Botanist working on wheat; the same man might quite easily be doing both things.

A.1021. You would not favour the idea of a committee having particular organisations devoted each to one part of the country?—Yes, if they are co-ordinated; but if the committee is going to be independent, then I think it is not a step in the right direction.

A.1022. Is one of the advantages of the Indian Central Cotton Committee this that it brings the growers and the intermediaries who carry on the distribution of the crop, those who process the crop in various stages and those who export it, into touch with each other and the Government?—I think the great advantage is that it brings the cotton worker, the trade and the Government into touch, but I do not think that it fully represents the interests of the cultivator.

A.1023. Can you suggest any means whereby the cultivator might be more adequately represented on the organisation?—I think that would follow if you had more co-ordination.

A.1024. More co-ordination between what?—More co-ordination between the Central Committee and the different Provincial Agricultural Departments.

A.1025. Do you think that the Committee is the body best qualified to speak for the cultivator? Is that your point?—No; I think the provincial departments would be better able to do that.

A.1026. Not necessarily the Imperial Department?—No.

A.1027. Do you wish to say anything about agricultural education?—No; I have not had much experience.

A.1028. Have you anything further to say about demonstration and propaganda? Have you much experience of that side of the work?—I had when I was in Sind, but since I have come here I have not had much experience.

A.1029. Do you form the view that the demonstration and propaganda organisation in the Provinces is as efficient as the research organisation?—I think it tends to lag behind.

A.1030. Is it because those responsible tend to spend more of the money that is available upon research than upon propaganda and demonstration?—I think that is so.

A.1031. And after all, propaganda and demonstration form the essential link between the laboratory or the experimental field and the cultivator?—Yes. I think the importance of technique (good farming) is sometimes lost sight of.

A.1032. I have one or two questions on the organisation at Pusa before I proceed to deal with your ideas on administration. Are you satisfied with the co-ordination of departments within the organisation at Pusa?—Yes.

A.1033. Is it one of your responsibilities to see that there is sufficient co-ordination between department and department at Pusa?—No; that is the work of the Director.

A.1034. But you are satisfied with the degree of inter-connection and inter-communication that exists?—I think it is very satisfactory.

A.1035. What have you to say about the co-ordination between Pusa and the provincial agricultural organisations?—I think it varies very considerably. We are in very close touch with some Provinces, but in other Provinces the case is quite different.

A.1036. How do you account for the difference between Province and Province in this respect?—In some cases a Province wants the advice of a man who has had experience in that particular Province. For instance, the advice of a man who has had his training, say, in the North-West of India would be discounted in Madras, and this is especially so in my particular Section.

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A.1037. We spoke a moment ago about post-graduate training. Have you anything to say about the desirability of establishing at Pusa, or wherever the central farm may be, an active and efficient organisation for post-graduate training?—We can as at present constituted, give a very good training here, with certain limitations.

A.1038. You are satisfied with the equipment for that purpose, I take it?—Only for a part of the training; not for a complete training.

A.1039. Are there not graduates undergoing post-graduate training at Pusa at this moment?—In my section two have been appointed and will shortly come to Pusa.

A.1040. Do you regard the figure of two as satisfactory for an All-India station?—I am afraid it is not in our jurisdiction in a way. These students are nominated by Provinces. We have no selective powers.

A.1041. Do you think that you are in a position to supply the teaching that is required? Do you think you are meeting the demand?—We have been meeting the demand as at present.

A.1042. Are you yourself satisfied with the figure of two? Do you think it shows that the school has a good name in India as a post-graduate school?—This place was never established for the purpose of a teaching establishment.

A.1043. Would you attach any importance to the establishment here of the tradition of post-graduate training?—I consider that Pusa from an agricultural point of view has been too much specialised to give a complete training. They might do part of the training here.

A.1044. Do you think that the establishment of a post-graduate school which would carry weight throughout India would be of advantage to the research side of the work of this Institution?—If we had the equipment and the means, certainly it would.

A.1045. In what respects do your equipment and your means fall short of the ideal?—In my own Section we have a staff which is only calculated to do the work without any educational duties to discharge. We have not any special staff for educational work and we are very short of buildings at the present moment. Only about two-thirds of my staff have quarters; I am not quite sure of the figure, but at any rate a large number of my staff have got no quarters.

A.1046. I will take you back to the matter of your notes. On page 125 you talk about administration and you say that the provincial agricultural organisation is developing unevenly. You say, "On the one hand we have the Punjab spending Rs. 14,00,886 in 1924-25 and on the other side Assam spending Rs. 2,72,768 and Bihar and Orissa spending Rs. 4,81,629." You do not contemplate Assam being in a position to spend for sometime as the Punjab is spending, do you?—No, but the proportion should be much higher.

A.1047. Do you know the conditions in Assam?—Yes; I have been in Assam several times.

A.1048. Do you think that Assam could find the money to spend a great deal more on agriculture than is at present being spent?—I think that the money could be found in Assam.

A.1049. Do you think that the stimulus of a fully developed central organisation acting in concert with the Assam Government might induce them to spend a larger sum of money each year? Is that your idea?—Not only that but we would then be in a position to help them.

A.1050. To help them to find the money or to help them to spend it?—To help them with money and to advise them in the spending of it.

A.1051. Do you accept the Reforms of 1919 so far as they affect the provincialisation of agriculture as a subject, and its transfer as something lasting?—I am afraid I am not really in a position to give evidence on that point.

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A.1052. Then to change the subject: I see on page 126 that you complain of being teased by the Government audit. Do you not see any means of escaping from them?—I think the audit might be more on a commercial basis.

A.1053. If you succeed in commercialising a Government department, then you will succeed in doing something which nobody has managed to do before. On page 127 you say, "central Executive authority has been found necessary in all parts of the world and a very good model for India to copy would be the Central Department in the United States of America." Are you familiar with the workings of the Central Department in the United States?—Yes; I spent six months in the States.

A.1054. When you say "executive authority outside the matters over which the central organisation has specific control," how much actual executive authority has the Central Department in America over the affairs of the States?—I will give you a concrete example. Some years ago there was a great cry about dry farming and it was published all over America what could be done in States like Texas. The result was that a large number of ranches were broken up and settlers were induced to come from the East and take up these areas on the specific advice of the States Governments. The Central Government then stepped in and established several experiment stations on the dry farm areas and they gave absolutely contrary advice to that of the State of Texas.

A.1055. They made public advice conflicting with that given by the State?—Yes.

A.1056. Is there any executive authority over the State?—I do not know.

A.1057. *Sir Henry Lawrence*: What was the result of the divergent advice?—It prevented a large number of settlers coming from the East and saved a lot of money.

A.1058. *The Chairman*: Probably if they had had any executive authority they would have exercised it in preventing the movement: but the position, in fact, is that they have no such authority. Do you wish to say anything about the problem of indebtedness amongst the agricultural population?—No.

A.1059. Do you wish to say anything about fragmentation?—No.

A.1060. In answer to our Question 4 (c) (ii) you say, "The present situation in India with regard to freight haulage, especially small parcels less than a truck load, can only be described as very bad." Is that a question of freights or conveniences?—In actual practice it may take a couple of months to get stuff up from Calcutta to Pusa.

A.1061. So it is a matter of service rather than of the freight rates charged?—Yes, the service.

A.1062. Further on you say: "In long distance hauls especially where there is a break of gauge, the situation is extremely bad." I take it, you speak feelingly from having to change more than once every time you come from Calcutta to Pusa. On page 123 in answer to our Question 10 on fertilisers you say: "Fertilisers could be used profitably to a much greater extent than they are at present on all capitalists crops and garden crops." What exactly is the "capitalist crop"?—A crop like tobacco, sugarcane, etc.

A.1063. *Professor Gangulee*: You mean commercial crops?—Yes.

A.1064. *The Chairman*: You mean money crops?—Yes.

A.1065. Your establishment here is engaged in developing better plants of various varieties. Better plants, I take it, have a capacity for taking more nourishment out of the soil than the poorer plants?—In the case of grain, that is so.

A.1066. Have you come across cases where disappointment has been caused to the cultivator because he has adopted your better varieties but has not appreciated the necessity for giving them more food?—Not frequently, but I have met such a case.

A.1067. Can you conceive of a case in which the fertility required to supply a particular variety of crop with sufficient nourishment, so as to insure

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that the land would not be progressively deprived of plant nourishment, would be so considerable as to make it hardly within the ryot's capacity to adopt it?—I think other factors come into play.

A.1068. You are, no doubt, familiar with that argument which has been advanced, are you not?—Yes.

A.1069. Now, in the matter of farm implements, do you feel that any substantial contribution is made towards the ryot's problem so far as that problem consists in improving his implements at this moment?—Yes, both directly and indirectly.

A.1070. Let us take "directly" first. In what way has it been met?—In many cases he has got an improved type of implement. I can give a case in point which happened in Sind. We introduced a new type of wooden plough. Last time when I was in that tract I did not see a single sample of the old plough.

A.1071. *Sir Henry Lawrence*: What type of plough was that?—It was an Egyptian wooden plough.

A.1072. *The Chairman*: Do you think there is a good deal more work to be done in that direction?—I think the work is only just begun.

A.1073. How is the problem being met by means described by you as "indirect"?—Take, for instance, cases like rice-hulling machinery. Rice-hulling machinery is very largely adopted and it is very largely to the benefit of the ryot. He indirectly gets a better price for his produce.

A.1074. I suppose the improvement of the breeds of draught cattle in India would probably be the most substantial indirect contribution towards the solution of this problem, would it not?—I think it is even better to prevent existing breeds from extermination.

A.1075. What do you think threatens the existing breeds with extermination?—In the case of the Saniwal cattle in the Punjab, the extension of irrigation has undoubtedly broken up the tracts which formerly supported large herds of cattle.

A.1076. You mean there are fewer cattle there now than formerly?—I do not say that.

A.1077. On this matter of cattle and the improvement of the breeds in India, do you think that a cross between European breeds and indigenous breeds is likely to make now, or in the future, a contribution towards the ryot's problem?—It might do it in the case where indigenous cattle are extremely bad. It has done it in a district round Patna.

A.1078. I do not quite follow you?—I say it has done it already in the district round Patna where the cross has been introduced and that particular strain of cattle is certainly better than the indigenous cattle.

A.1079. That is because the indigenous cattle were so very bad?—Yes.

A.1080. Could an equal improvement have been effected by the introduction of a better breed of indigenous cattle in that area?—I doubt it because the milk factor would come into play. This cross gave a much larger yield of milk and so it held its place.

A.1081. What breed of cattle are you referring to?—It is not a breed; it is only a strain. It is called the Taylor breed and various other names; but it is not a breed.

A.1082. That was a cross between a Kerry bull and indigenous cow?—I do not know whether it was Kerry or Shorthorn.

A.1083. *Sir Henry Lawrence*: When was that introduced?—I am not quite sure when it was introduced.

A.1084. *Sir Thomas Middleton*: It was introduced more than half a century ago?—Yes.

A.1085. *The Chairman*: Do you attach importance to the development of a dual-purpose animal capable of providing the maximum amount of milk and also providing males capable of effective work in the fields?—I think it

is very important, but I do not think it is as important as the taking of all possible steps to keep existing breeds of cattle uncontaminated.

A.1086. Are you familiar with the work which is being carried on by Mr. Warth at Bangalore on animal nutrition?—Yes.

A.1087. Do you attach importance to that work?—I attach very great importance to it.

A.1088. Do you think there is a great field still to be exploited in that direction?—Yes; I think the work is only in its preliminary stage.

A.1089. Have you ever thought about the milk-yielding side of the problem in its relation to the improvement of the diet of the cultivator and his family?—In some districts it is a very important matter. They say that in Sind it takes five cows to keep a family. That is an example of a milk-drinking tract.

A.1090. On page 130, in answer to Question 17, you say, "there is always far more employment in Sind than there are labourers available, and the same applies to Bihar. As long as this is the case, I see no reason for encouraging subsidiary industries." That, of course, I take it, means that in particular tracts where there is sufficient occupation, you would not spend any money in popularising subsidiary industries. In that answer, would you include subsidiary industries, or rather spare-time occupations, carried on by the women?—I have been many years in Sind and I have seen cotton lying on the ground because there were not sufficient people to pick it, and the occupation of picking is very largely women's occupation. So, I do not see the need of spending money in that direction.

A.1091. In those particular tracts?—My evidence is entirely in regard to those tracts.

A.1092. On the same page you point out the fact that migration of labour from one district to another is difficult, because it has sometimes been found to be the case that such labourers do not thrive in the district to which they go. Is it really the case that colonists going from Gujarat into Sind have died?—Yes.

A.1093. What killed them?—Probably malaria and heat.

A.1094. They could not face it?—They could not.

A.1095. On page 131, in answer to Question 19 "Forests," you say, "The questions under this head are largely local, but in one case the destruction of forests on upland country which occurred gradually in Chota-Nagpur has not only led to soil erosion but the whole climate has altered." Do you know whether the meteorologists of these days support the theory that deforestation affects the climate itself?—I do not know. My evidence is based on what I have been told by planters who have been in that district for many years.

A.1096. You are talking about pretty old times?—Yes.

A.1097. I am interested to see what you have to say about the marketing of wheat from the North-West. Is there great fluctuation in the volume of wheat available as the exportable margin from year to year?—Yes, very great.

A.1098. Would that be a serious difficulty in attempting to attract capital for, let us say, the modern system of marketing by means of grain elevators and ships designed to load from elevators?—It seems to me that there is a large amount of money invested in it at present; fluctuations do not seem to affect trade at present.

A.1099. Are you thinking of grain elevators?—Yes, grain elevators.

A.1100. Is there a large amount of money invested in grain elevators in the North-West now?—Little; there is only one grain elevator, so far as I know, in the whole of the Punjab.

A.1101. In what is this capital invested?—Rolling stock, docks and plinth areas.

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A.1102. You know, of course, that for a fully developed system of export by means of elevators, you have to have not merely elevators, but also your ships designed to load from elevators? Would it not mean a very considerable tying up of capital?—On the other hand, it would free a lot of capital which is at present invested in rolling stock, harbour works, and godowns.

A.1103. Do you think that capital could be made liquid by an operation of that sort?—I should think valuable dock land could be sold.

A.1104. Have you any experience of agricultural co-operation in India?—Very little.

A.1105. Do you form any view about its usefulness as a contribution towards the agricultural problem?—I am not in a position to speak on it.

A.1106. Are you interested in general education in relation to agriculture?—I am hardly in a position to give evidence on that.

A.1107. In the matter of attracting capital, how would you suggest that the Provinces who are interested to do so might encourage outsiders to invest capital in agriculture?—Where Government land is being given out, conditions might be made to enable people with capital and with the proper knowledge to buy a certain amount.

A.1108. Are you thinking of establishing men on the land with large holdings, men who might be called planters?—Yes.

A.1109. Do you think that would be in conformity with present day policy?—To a limited extent.

A.1110. Do you come into contact at all with agricultural matters in the Indian States?—I have been on several advisory tours to Indian States.

A.1111. Is it your experience that Indian States are ready to co-operate with Governments in British India for the advancement of agriculture?—The States vary very considerably in that respect.

A. 1112. Are there any costing experiments being carried on at Pusa at this moment?—Yes.

A.1113. Would you describe a typical one?—We take a unit and all the work expended in cultivating that unit is put down daily.

A.1114. *Professor Gangulee*: For each crop?—Yes, for each crop. We have got complete data, since this place started, of the cost of cultivating every field.

A.1115. *The Chairman*: That is the cost of cultivation?—Yes, and of bullocks, but it does not include any overhead charges.

A.1116. Have you got the value of the crop?—We have the value of the crop and the outturn.

A.1117. Am I right in thinking that in an experimental station it is difficult to draw conclusions from comparisons between the total cost of cultivation and the value of the crop, because you are concerned rather with the carrying out of a particular experiment than making money?—That is so; and other difficulties arise, because it is not the case of one experiment; we might have a whole mass of experiments one overlapping the other.

A.1118. *Professor Gangulee*: Do you take into consideration bullock power?—Yes.

A.1119. *The Chairman*: So that, as a contribution towards the analysis of the cost of the cultivator's work, you are not really going very far here at this moment?—No.

A.1120. Do you think that might be a very useful field of work?—I should think it would be very useful indeed for a provincial department, not for a central department.

A.1121. Has any work on sheep been carried on at Pusa?—We have had sheep here for some considerable time, but owing to extensive flooding which we get in Pusa, we have had much damage from liver fluke; so, it is not a good centre for sheep.

A.1122. Have you done anything with goats?—Nothing.

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A.1123. Is the goat an important animal in the agricultural economy of India?—Yes, it is important.

A.1124. You know the history of the improvement of milk-yields in particular breeds of goats in Europe?—I have read about it in agricultural journals.

A.1125. And the remarkable success it has attained?—Yes.

A.1126. Do you think that is a line which might be examined?—In some parts of India there are great possibilities for it.

A.1127. Have you considered at all the problem of whether the export of bones from India should be allowed or should be discouraged or prevented?—Under present circumstances, I would not be inclined to advise any interference with the export.

A.1128. *Sir Ganga Ram*: Not even an export duty?—No, I think I would not interfere in any way; not even an export duty.

A.1129. *The Chairman*: Are you familiar with the Military dairy farms?—Yes.

A.1130. Their cows are almost entirely first crosses between European and indigenous breeds?—They vary; in some farms they have got pure Indian cattle, and in others crosses.

A.1131. Their primary object is to provide milk for the troops?—Purely milk.

A.1132. Have you ever considered the possibility of the Agricultural Department taking over some or all of those farms?—I should be very sorry indeed to take over these farms.

A.1133. Why?—Because a lot of them are very badly situated.

A.1134. Have you coveted any of them?—One or two are very good; I would take Ferozepore.

A.1135. You think there is a case for taking that over?—I do not think so. If we took them over it would be in the nature of a compromise. I think it is very much better to acquire land and do the thing properly in the first instance.

A.1136. By compromise you mean that you have to undertake to continue the supply of milk and that will have to be carried on in conjunction with any experiment that you might wish to make; is that the point?—Yes; that is so.

A.1137. *Sir James MacKenna*: With reference to the organisation of the staff at Pusa and in the Provinces I see at one stage you say: "At this time the Heads of the sections at Pusa should have been raised to at least the grade of Directors of Agriculture and made responsible for the activities of their sections throughout India." Do I understand you correctly if I say you mean that you would have, at Pusa, the Imperial Agricultural Chemist as the Head of all the chemical work in India and the Economic Botanist controlling all economic botany in all the Provinces; that is the substitution in effect of several Agricultural Advisers for one, and with a great deal more power than the present Agricultural Adviser has? Is that your scheme?—Not exactly. I did not suggest that any section or extended section should have any power of interfering with the corresponding section of the Province; but that he should keep in touch with the work that his branch is doing in the different Provinces and be in a position to advise the Government of India on his particular branch.

A.1138. That is to say, you would have had advisers in all the branches of agricultural science, the Imperial Officer at Pusa advising on his particular branch of agricultural science to the Government of India?—Yes.

A.1139. In your experience of Pusa do you think that the Provinces would accept a scheme of this kind?—I fail to see why the Provinces should object; it is to their advantage. You instance the case of the Chemist. The Chemist probably is trained in a Province and he is in touch with the chemical work going on in all the Provinces and so he is in a position to advise the Govern-

ment of India on his own branch. I think the Provinces will be quite pleased to have it.

A.1140. Is that your personal view or is that based on your actual experience? Have you found the Provinces so extraordinarily well disposed towards Pusa as to accept a scheme of that kind?—I have had no difficulty except in one or two instances.

A.1141. What is your view of the future organisation of the department in detail? How would you like the department to be organised with reference to Pusa?—My ideal is that the Imperial Department should not be so closely identified with Pusa. It ought to have stations in other parts of India.

A.1142. Then with reference to the Indian Central Cotton Committee, is it your view that the Committee has gone considerably further than what the Indian Cotton Committee had recommended?—Yes.

A.1143. You see a certain danger in it?—Yes.

A.1144. It has become too powerful altogether?—Yes.

A.1145. Are you in favour of entrusting special research on crops principally to the Central Committees and Bureaux?—I would have special branches of the Agricultural Department investigating special crops; but I would not give it over to independent bureaux. I would bring bureaux into the various branches of the department.

A.1146. You would insist on co-ordination of these bureaux? You are afraid they are apt to run away to their pet subjects and become rather too powerful?—Yes.

A.1147. Assuming that there was a centralised control of agricultural work in India, would you bring the Indian Central Cotton Committee under their control?—Absolutely.

A.1148. On the question of finance of these central bodies, you told the Chairman that you thought the trade could contribute as has been done in the case of the cotton crop. Do you think that will be feasible in the case of rice, for instance?—I think it would be to some extent. It has been done in the case of lac and cane to a certain extent.

A.1149. Would not the incidence of rice be rather unequal and fall rather heavily on certain Provinces?—Then the advantage would be to those Provinces more than to the others. But the amount is very small and I think it would not be a very heavy burden.

A.1150. You know the method of raising money for these central bodies by a form of tax or levy from the trade. Could not that money be earmarked for any particular crop from which it is derived?—I would not apply it to the particular crop.

In that case I must tell you what the case would be about rice. Even assuming a very low assessment, 80 lakhs of rupees would be paid by Burma alone and inter-provincial jealousy is likely to arise.

A.1151. One or two questions about your past experience. You had been Deputy Director for many years before you came to Pusa. Could you tell us in what way, if any, Pusa was of use when you were a Deputy Director yourself?—It was of very great use indeed. Mr. Mollison visited my place on three occasions. When he came to me on the first occasion I had not a bungalow in the place. After leaving me he went down to Bombay and saw the Government of Bombay and insisted on building me a bungalow. On the next occasion when he came he got a big grant for reclamation work and on the third occasion he got me more money.

A.1152. So the assistance was largely financial?—And advisory.

A.1153. But then he was Inspector-General. I want to know whether you got help from any particular section at Pusa during your Deputy Directorship?—As a matter of fact I did not get very much help because it was entirely a new department; Pusa had not been sufficiently organised to get much benefit from it.

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A.1154. At present are the Provinces using your different sections?—Yes; a very large number.

A.1155. What problems of basic importance to agriculture are you looking to here? Will you just mention a few?—Cattle, upkeep of fertility and general technique.

A.1156. These are all enquiries of general importance to the Provinces as well as to local farming here?—Yes.

A.1157. Are there any other problems you have in mind that should be taken up on the agricultural side?—I should like to have increase of machinery.

A.1158. You think a lot of work can be done on that side?—Yes, but not necessarily by Pusa.

A.1159. Are there any limitations for the Provinces to fully utilise you?—I do not know of any.

A.1160. Are there not difficulties that have arisen under the new Devolution Rules in restricting the amount of touring and so on?—That comes under what I said about accounts.

A.1161. Now about your half-bred cattle, you hold annual sales here which are well attended and where very good prices are obtained. Are all these cattle inoculated by the simultaneous method before you put them up to auction?—Practically all. With a very few exceptions they are all simultaneously inoculated against rinderpest.

A.1162. Do you sell any cross-bred bulls?—No cross-bred bulls.

A.1163. Have there been any complaints from the buyers as to excessive mortality amongst these cattle as a result of rinderpest or other disease?—No.

A.1164. You have had no complaints from them that these cattle are more liable to disease than the ordinary cattle?—No.

A.1165. Are any obstacles put in the way of ingress to, or egress from, Pusa by the Railway Companies?—Yes. There are two Railway systems, the B. and N. W. Railway and the E. I. Railway and I do not think they fit in very well. Coming here from the Punjab, the Punjab mail comes in 20 minutes after the steamer leaves, which means staying the night in the station.

A.1166. Have no representations been made?—I believe representations have been put up but no action has been taken.

A.1167. Do you think that the teaching side should be extended at Pusa? Have you any ideas as to how you could improve it?—We should have a large number of short and special courses, for instance, in the installation of power machinery, the technique of cattle-breeding, fodder growing and so on.

A.1168. Do you foresee a day when Pusa will be able to give a complete post-graduate course in agriculture to qualify for direct appointments in the Indian Agricultural Service?—I should think it would be better if the course comprised a certain amount of training elsewhere in addition. I am talking especially of my own section and not of the scientific sections.

A.1169. How would you train these men for the Indian Agricultural Service?—In India now we have certainly got a nucleus for a very good training.

A.1170. Where?—Suppose they have taken their degree in one of the provincial colleges and they want to specialise, we will say, in cattle work, they can be given sometime at one of the Military dairy farms such as Bangalore, so long here, and a spell abroad.

A.1171. But would it not be better if we really had one institute where this class of teaching should be given, instead of waiting until one of the provincial colleges asserted its superiority and its position were recognised?—We could do it undoubtedly.

A.1172. Do you not think it has got to be done?—Yes; but I think the complete training should not be done here; I am talking from the point of view of the Agricultural Section.

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A.1173. That is on account of the peculiar conditions under which you work here?—Yes.

A.1174. The limitations on the agricultural side?—Yes, you see we cannot give them any experience in irrigation.

A.1175. That is perfectly true. There is no wet cropping; so that really from the point of view of a complete agricultural course Pusa is unsuitable?—Yes, I think it is.

A.1176. It has these limitations?—Yes.

A.1177. *Professor Gangulee*: But you would have those sorts of limitations everywhere; could you select a spot where you would have all the facilities?—I would not select one spot, but I would arrange the course of training to get as many factors into the training as possible.

A.1178. Here you have already developed, if I may say so, a sort of scientific atmosphere; would you not prefer to utilise this institution for post-graduate training?—For part of the training but not the complete training. I think a man who is trained here and nowhere else would not be in a position to go all through India and be classed as a first class expert.

A.1179. Do you approve of the idea of developing Pusa as a post-graduate teaching institution?—Yes.

A.1180. Then if you agree on that point and if you have M.Ag. or M.Sc. students, do you not think you would have sufficient material here with which you could build up post-graduate agricultural education?—Do you refer to my section or all sections?

A.1181. The Institution as a whole?—I am not in a position to speak about the other sections.

A.1182. You refer to general technique in field experiments; are you working to develop a suitable plot technique?—Yes.

A.1183. For the purpose of carrying on experiments?—Yes.

A.1184. Do the members of the provincial departments visit your farm to study that technique?—They do on occasions; Boards of Agriculture and so forth come and study our methods.

A.1185. Most of the Provinces have to carry on experiments in the fields?—Yes.

A.1186. Are they familiar with your plot technique?—I should say they are, yes.

A.1187. Could you tell the Commission the procedure you adopt in planning your crop experiments?—I can give you full details; I am just starting a new series of plots on sugarcane in conjunction with the Imperial Bacteriologist and the Secretary of the Sugar Bureau. We are working on it just now and I can put all the documents at your disposal.

A.1188. Then you do consult with the other experts of the department?—Yes.

A.1189. In such field experiments you make an attempt to view the problem in all its aspects?—Yes.

A.1190. Do you attempt from an experiment to get complete data from all points of view? Can you tell the Commission whether you have carried on any experiments of that sort?—I am afraid I do not quite follow you.

A.1191. Let me explain. Supposing you are carrying on experiments with regard to the water requirements of a crop; you ask the Bacteriological Section to study the problem from the bacteriological side, you ask the Chemical Section to study it from that side, and you ask the Entomological Section to find out the incidence of pests in relation to water and so on; that is, when you tackle a problem do you try to get complete data in all its aspects?—Undoubtedly.

A.1192. Could you tell the Commission of any experiment that was done in that way?—We will take the permanent manuring experiment; this experiment was designed by the Board of Agriculture in India.

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A.1193. You are referring to the Punjab field?—Yes. This experiment was designed by the Board of Agriculture but it has had slight modifications since that time.

A.1194. I noticed this morning in going about the fields that you were carrying on various experiments with leguminous fodder crops?—Yes.

A.1195. Have you asked the Department of Animal Nutrition to ascertain the feeding value of these crops?—When they have got beyond the preliminary stages, we take all the necessary steps to try that.

A.1196. So that you are in touch with the Department of Animal Nutrition at Bangalore?—Yes.

A.1197. Have you at any time undertaken any experiments at the suggestion of the provincial departments?—Yes.

A.1198. For instance, has Bengal asked you as Imperial Agriculturist to carry on an experiment which they were unable to carry out? Can you give us an instance?—We are doing quite a large amount of work for the Director of Agriculture in Bengal, chiefly on fibre work; we grow fibre for him, we ret it for him and send him the result.

A.1199. Are retting experiments done here also?—In the last series of experiments we carried out, we tried to extract a fibre by mechanical means; this instrument was designed at Dacca and it has been tried here.

A.1200. So you do carry on experiments here at the instance and suggestion of the provincial departments?—Yes.

A.1201. Besides Bengal, has any other Province come forward and made suggestions to you?—I have had suggestions from the Punjab, I have had them from Bombay and from the Central Provinces.

A.1202. So that in that way you are in touch with other Provinces?—In touch every way.

A.1203. Has it been possible for you to verify any results obtained by the provincial departments in their field trials?—I cannot give any instance off-hand in the case of crop trials. If, for instance, a new fodder is recommended by a Province, we give it a trial here and see how it fulfils our conditions.

A.1204. In your note you say, "it is my opinion that the first step should be that of setting the administration in order and an orderly survey made of the means available for an organised attack on the present terrible state of agriculture and livestock in India." Do you suggest that up to now there has been no organised attack on the agricultural problems of the country?—No, I do not suggest that, but I have a feeling that development is going on very unequally, and I suggest that a further amount of co-ordination would be of very great benefit.

A.1205. So that your point is this; there has been an organised attack but not sufficiently co-ordinated?—That is so.

A.1206. Or, if I may say so, there has been an organised attack without sufficient organisation?—Yes.

A.1207. Whose fault is that?—The whole problem of agricultural improvement is absolutely modern; it has not had time to get going.

A.1208. And you think "setting the administration in order" would solve the problem?—It would, certainly, if it were on a business footing.

A.1209. When you speak of setting the administration in order, what have you actually in mind?—I have this in mind; we will say within the last 20 years the subject of improvement in agriculture under modern methods has been really started. It seems to me that we are going ahead in a very unequal manner; some Provinces are doing very good work and spending a lot of money; other Provinces are doing very little. Various semi-independent and other organisations are starting, and it seems to me that we shall get into a state of chaos if we go on like this; it is time that the whole subject was systematically gone into and some idea obtained of the means available for carrying out the work.

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A.1210. For that purpose you propose to have a central body?—Yes.

A.1211. Let me see how you would form that central body. Would you call the Imperial Department of Agriculture a central body?—It is a central body, yes.

A.1212. Then how do you explain this, that this Imperial Department of Agriculture, which you admit is a central body, did not succeed in establishing a system of organised attack on agricultural problems?—Because it has never yet had a chance. It is still in its infancy.

A.1213. After 20 years' growth it may be said to have reached the adult stage. On page 125 of your *précis* you state; "If the present state of affairs continues, some of the Provinces will have a very large organisation and will completely overshadow not only the other Provinces but also the agricultural machinery of the Central Government." Why are you alarmed at the possibilities of the Provinces developing a very large organisation?—I am not alarmed at all; I am only too pleased.

A.1214. Why do you think such development would overshadow and not assist the Central Government?—If they expanded to such an extent they would simply take all the best men away from the Central Government.

A.1215. There would be demand for better men?—Then the better men would be confined to a water-tight compartment. You would probably have your first class men in the Punjab and very inferior men elsewhere. There is no equality about the thing at all.

A.1216. Then, further on, you say with reference to Pusa that the body of scientific experts working in the Central Institute would have less and less connection with current agricultural affairs in India, as the development of the Provincial Agricultural Departments increased. I cannot understand why that should be the case?—That is only my opinion.

A.1217. Could you kindly explain why you anticipate this difficulty?—I anticipate that difficulty if you have an unequal growth of development in one place as compared with another place where you might have nothing at all. You would in that case get all your best men removed.

A.1218. But, in any case, if the tradition of Pusa is properly maintained there ought to be no danger?—I think there will be very considerable danger.

A.1219. Would you agree with me that such difficulties could not arise if the organisation of the controlling body of experts were made sufficiently elastic and the personnel engaged in research were properly selected?—That would undoubtedly go a long way to meet the case.

A.1220. Then with regard to the Institute, what definite proposals have you to organise Pusa so that the work on the central farm and the central research station can be made inter-related and inter-dependent, thus forming an essential structure in the agricultural organisation of the country?—I would extend Pusa by having stations in other parts of India.

A.1221. You make a reference to the Central Department of the United States. Is not that really a correlating agency? You say that it is an executive body. I think the Chairman pointed out to you that it was not. I was in the United States for some time and my impression is that it is really a correlating agency?—I am open to contradiction, but I was under the impression that they had essentially executive functions.

The Chairman: I said that as regards certain specific subjects; for instance the regulation of export and the duty of protecting the country against the importation of plant pests and the like.

A.1222. *Professor Gangulee:* Apart from certain reservations which the Federal Government make, the departments are quite independent and they have entire freedom in their own organisation and administration?—But if the Central Government wanted to carry out investigations I was under the impression that they had the power to step into that State and carry out the experiment by establishing a station in any Province.

The Chairman: At their own expense.

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A.1223. *Professor Gangulee*: Without interfering with the work done by a particular State?—Yes.

A.1224. Here we have a note presented to us by the Agricultural Chemist to the Government of the Punjab and he also says that the State Departments have entire freedom of action in their own organisation and pursue their own independent lines of research. And further he says that they get material encouragement and assistance from Washington and that States vie with each other in the matter of catching the eye of the Federal authorities in receiving their grants. You said that you paid a visit to Canada. Have you had an opportunity of studying the organisation of the central farms of that country?—Yes.

A.1225. Could you very kindly tell the Commission how the work of co-ordination and organisation of these central farms is carried on in the different parts of Canada?—The station I was at was Guelph and they had a central farm there at which they tried new varieties. Then they had a chain of subsidiary farms in different districts and from there the improved varieties spread right through the whole tract.

A.1226. Yes, they are developing a very great deal. I saw some of their organisers at the Wembley Exhibition and that was the impression I was able to gather. You say the central body should include the Director of Agriculture. Would you not include the representatives of the Irrigation Department, or the Co-operative Department?—I would certainly include them. They would be essential for closer co-operation.

A.1227. You make a remark about the use of cowdung as fuel. Do you consider the practice of burning cowdung a serious one?—My experience is confined to Sind and I think it is not a matter of very great importance there.

A.1228. Have you had any occasion to study the conditions in Bengal or Bihar?—Not in Bengal, but to a certain extent in Bihar. A lot of cowdung is got off the roads and from grazing grounds and so forth and it is almost always in a very dry condition. I do not think that it is a matter of primary importance.

A.1229. Have you an Agricultural Engineer attached to the Pusa Institute?—No; I attend to that branch.

A.1230. Have you any arrangements for testing different kinds of machinery?—I have tested several lots of machinery and several implements in different Provinces. I have tested the threshing machinery at Lyallpur; I have tested various things at Cawnpore and at Poona.

A.1231. Are you in touch with any Indian manufacturers?—I have seen factories in places near Dharwar.

A.1232. *Mr. Calvert*: One page 124 of your written evidence you say, "The whole question of grading of export crops needs thorough investigation." Might I ask why you lay stress on export crops?—I think the point of greatest importance is that improvement could be effected most quickly on export crops. The other point of view is that the grading of non-export crops would be attendant with very considerable difficulty. I think that immediate benefit could be obtained by taking up export crops.

A.1233. But any improvement in the marketing of export crops would only lead to a better price of the portion exported?—Eventually the cultivator would get a better price for his product.

A.1234. It would not reflect on the portion consumed locally?—I think it would, indirectly, in course of time.

A.1235. But the total proportion of agricultural produce exported is a very small part of the whole?—Yes.

A.1236. So that that leads one to the charge sometimes brought against the Agricultural Department that they devote too much attention to the export crops and not enough to the home consumption crop?—It would not be a sound piece of business not to start work where you would probably get the quickest result.

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A.1237. In the case of Bengal rice, I gather none at all is exported. You could not improve the export marketing of Bengal rice?—No, I should think the department should tackle the question of Bengal rice by getting better seed and bettering the facilities for buying seed, helping in the manure, etc.

A.1238. Would you like to offer any opinion on the charge that departments devote too much time to the crops that go to Europe?—No, I do not think there is really very much in that.

A.1239. Just a point which Professor Gangulee took up about certain Provinces going ahead faster than others with the development of the Agricultural Departments. You would not go so far as to restrain their progress?—Certainly not.

A.1240. The mere fact, to take your figures, that the Punjab can afford 14 lakhs and Assam only 2 lakhs would not be an argument to keep the Punjab back?—No.

A.1241. Suppose that applied to Pusa, would you object to other Provinces going ahead if Pusa could not secure the funds?—No.

A.1242. I have not quite grasped the point of your argument here?—It seems to me that at Pusa the Central Government are lagging behind. We started with a certain ratio, as it were, and the expenditure was pretty even all over the Provinces; and now while some Provinces are going ahead, others are lagging behind.

A.1243. The main object of all these activities is the welfare and prosperity of the agricultural class?—Yes.

A.1244. As long as that end is achieved it does not really matter whether the work is done by the department here or in a Province?—It seems that it pays the Punjab to spend their money and they are pleased with the result, and if that applies to the Punjab it applies equally to other parts of India as well.

A.1245. Would not the success attained in one Province serve, as a spur to more laggard Provinces?—That is to be hoped for, certainly.

A.1246. I was not quite certain about the trend of these arguments?—The trend is that the Central Government should spend more money and keep up the organisation of the Central Government in proportion as expenditure increases in the Provinces.

A.1247. The argument is a local argument applied to the position of the Imperial Department?—Yes, that is so.

A.1248. And similarly, you say later on that all initiative would pass from the Government of India in agricultural affairs. Why should not the initiative lie in the hands of more progressive Provinces?—In the case of a problem which is common to several Provinces it is a case for the Central Government to act. I do not see why the Punjab, because it spends a large amount of money, should advise Provinces like Madras or Bombay; as long as they are co-ordinating their domestic problems they are absolutely within their right.

A.1249. But a great deal of work done in individual Provinces is of All-India value?—To a certain extent.

A.1250. But you want co-ordination of authority. Work may be carried on in the Punjab which is of value to Madras but who is going to be the connecting link? Is it your opinion then that the co-ordinating authority should also have with it a body of expert research workers apart from the provincial workers?—Yes, I think so, there ought to be a staff of sufficient scientific weight to act as co-ordinating authorities. For instance, if a chemical problem is being investigated in the Punjab which is of value to Madras, you must have a first class Chemist at the headquarters to translate it into practice, otherwise the work going on in the Punjab may never be heard of in Madras.

A.1251. You do not contemplate a time when the provincial departments will have extended to an extent which would render an Imperial Department

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unnecessary or redundant?—I do not see how that can be done very well because, if your expansion is so unequal, I do not see how it is possible to get rid of the Central Department.

A.1252. Take the case of your own department. What work are you doing now at Pusa which could not be done or is not being done in the Provinces?—Nothing. Everything I am doing could be done in the Provinces.

A.1253. It could be done by a provincial department?—Undoubtedly.

A.1254. In another place you suggest that the Heads of Sections at Pusa should have been raised to the grade of Directors of Agriculture. Were you thinking of their pay or of their official status?—Both.

A.1255. You do not think that their scientific reputation will be sufficient to give them the due weight?—No, I do not think it would be sufficient to give them due weight under the circumstances.

A.1256. Coming to the question of new crops, you say on page 129, "In most districts there is cast-iron custom as to the staple food grain." Do you not think you are a little too rigid there in view of the change of diet that is taking place in various Provinces?—I can only speak from my experience. I have known a case where in a *bajri* tract they would not eat *juar*, and in a rice tract they would not touch wheat. I have known of cases where new rice has been brought in from some distance and the people in that tract would not touch it.

A.1257. That may be merely the objection to something new?—I do not say the custom is unalterable, but I say it is very strong.

A.1258. It is hardly cast-iron; you have expressed it a little too strongly?—I do not mean to infer that it is absolutely unchangeable, but it is a difficulty in the introduction of new crops in many cases.

A.1259. Still, there is considerable evidence that new crops are being introduced and people are altering their consumption in response to them?—I do not mean to infer that my remark applies to all the new crops. In many cases when you bring in a new crop it is taken up with avidity; but I say that in some cases it does occur.

A.1260. Are you barring agricultural improvement through the introduction of new food crops?—Certainly not; I have merely pointed out a difficulty which exists in some cases.

A.1261. But it is not universal?—No, it is by no means universal.

A.1262. For instance, potato is spreading very rapidly?—Yes, and Pusa wheat is spreading very rapidly. I have merely instanced that as an obstacle.

A.1263. But it is not an insurmountable obstacle?—No.

A.1264. Now, with regard to the question of Animal Husbandry. Do you think that the sentimental view with regard to the cow is a bar to an improvement in the livestock?—I consider it a very great bar in some tracts.

A.1265. It is a great difficulty?—Yes.

A.1266. You say that the actual working days of bullocks in Sind amount to 100 or 120 days. Is that a guess or is it a careful calculation?—That is a calculation based on one particular village of which I have got experience; it is actual fact.

A.1267. On the question of marketing of wheat you say that "the trade interested however does not recommend any change and a thorough inquiry is necessary and very drastic action on the part of the Central Government." Do you stress the word "Central" there or would you allow Provincial Government to make the inquiry?—It struck me that it was a problem common to several Provinces. It is not only the Punjab problem but it is also the problem of Bombay and the United Provinces.

A.1268. Still the problem is sufficiently big in a single Province to justify an inquiry?—Undoubtedly.

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A.1269. And actually the inquiry is being made by the North-Western Railway which is an Imperial department, but it might again be taken up by a provincial department?—Yes.

A.1270. Would you kindly let me know what you consider is the change of attitude necessary on the part of the Provinces in order to attract capitalists to take up agriculture?—In some Provinces it is more or less a settled policy not to encourage people from outside that Province to take up land.

A.1271. You are thinking of the Punjab probably?—As a matter of fact, I was thinking of Sind.

A.1272. What change of attitude do you want?—I do not want any change of attitude; I have merely suggested that that would be necessary if outside capital were to be attracted. I do not recommend it.

A.1273. On page 131 you say, "It is very seldom that owners are found who actually cultivate their own land." I presume you mean large owners?—I was referring to this side of India; this side of India is very exceptional.

A.1274. Could you make any suggestion as to how these owners could be encouraged to take a more active interest in agriculture?—I think Mr. Sayer made a suggestion sometime ago that if the Honours lists were more used for cases of advanced agriculture, that might help a bit.

A.1275. You do not think that has been done sufficiently now?—No. I know from my own experience as a Deputy Director in Sind that a recommendation, say, from the Police Department or from the Irrigation Department went very much further than a recommendation based on the fact that the man was a good zamindar.

A.1276. An opinion has recently been given by the President of the Science Congress that these new crops do not take more out of the soil than the old crops; that it is merely a question of getting a more efficient plant machine. Do you agree with that?—That can be absolutely proved or disproved by chemical analyses.

A.1277. What exactly is the general ideal that you are aiming at in the Agricultural Section? Is it to get crops which will make better use of the soil, ripen more quickly and take up less time, or to get a crop which will give a bigger yield?—There are several factors. In some cases it would be a matter of expediency to get a crop which could mature with less water; in some cases it would be more expedient to get a higher yielding crop; it is not always the same aim. The object might be to get an early ripening crop as we do here in Pusa. In many cases, I should think that if your crop gives a higher outturn, even at the expense of reducing the fertility, it is sound business to get a higher outturn and an immediate return unless fertility is going to be reduced very considerably; it is better to have the money at once if you can get it.

A.1278. One of the pieces of evidence given to us is that improved varieties require more careful cultivation and better manuring; is that generally true?—I do not think it can be laid down as a general rule. It may be so in some cases, but unless the difference in yield is very considerable, I do not think there will be very much difference in the effect on succeeding fertility.

A.1279. As to the question of Honours, do you not think people will give up their farms when they get their Honours?—I should think it would have a very good effect in the district. After all, the same principle might apply in giving an Honour for anything.

A.1280. Do you think it might be of real permanent value?—I should think so.

A.1281. Do you not think that a certain class of men does work for Honours and a certain class of men does work for the sake of work, and that the latter is often the better man?—The man who recommends him is responsible for selecting the proper type.

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A.1282. I should like to make the question about costings more clear. Is this inquiry in which costing is being done under your control?—We keep a record of all the costings of all the crops of this farm.

A.1283. Of the farm you showed us this morning? How is it entered up everyday? Do you enter the hours of labour?—We enter the hours of labour, the number of bullocks used and the actual operation.

A.1284. How are you going to assess the value of the work done by the bullocks?—If a pair of bullocks work for half a day, we put down their rate for half the day.

A.1285. Then you are putting down a conventional rate for the bullocks?—Yes.

A.1286. How is that arrived at?—On the basis of our experiences and also on the basis of what it costs to hire a pair of bullocks.

A.1287. But you have just said that you found that bullocks were used only from 100 to 120 days in a village. Assuming that to be correct, you have got to allow somehow for the cost for 240 or 260 days?—If you will read my evidence you will find that my figure refers entirely to Sind. We can get quite a good basis of comparison by the rate it costs us to hire a pair of bullocks. Of course, we hire a number of bullocks and we know the rate at which they are hired.

A.1288. That would not give you the cost of cultivation?—It gives an idea of what the bullocks cost.

A.1289. That would give you the cost of hiring the cultivator's bullocks, not the cost of cultivation?—That is what we have done so far.

A.1290. You are not trying to work out the cost of keeping a pair of bullocks for a year and dividing the cost by the number of days they work?—We have sufficient data to work it out quite easily.

A.1291. Are you in favour of a more intimate study of rural economics in this country?—Yes.

A.1292. Do you think it would be of value to you in your work?—It could not be of very much value in my present post, but I think it would be of great value generally.

A.1293. The major part of this country is cultivated in small holdings up to about 12 to 15 acres. Do you think the methods you are working out now are suitable for the small cultivator?—No.

A.1294. As far as I have seen, practically no attempt is being made to work out the type of cultivation suitable for these small holdings?—That, I presume, is being done by the Provinces.

A.1295. We have not yet found any Province where it is done. This machinery which you showed us is not suitable for the 3-acre man?—No.

A.1296. There is nothing being done here to try and improve agriculture as it is understood by 90 per cent of the agriculturists?—We are working on specialised problems. But although, as you say, the larger proportion of Indians cultivate it in very small fragments, still there is a very large amount which is cultivated in big estates.

A.1297. Big estates form a very small percentage of the total area?—And when you come to dairy work, it will have to be on a big scale.

A.1298. It practically means dairy work is outside practical politics?—No; I would not agree with that, because the milk supply of cities like Bombay and Calcutta must come within practical politics.

A.1299. You are not working out any model to copy?—The improvement of milk supply is the important point.

A.1300. Do you think there is any connection between this concentration of the various Agricultural Departments on large scale farming, and the failure of graduates of agricultural college, to take to agriculture?—I do not think there is any connection.

A.1301. You do not think the fact that agricultural graduates do not take to agriculture is because the agriculture they have learnt is not suitable

to the Province in which they live?—In the first place, you cannot teach practical farming in any educational institution; you have got to learn out in the open; you cannot teach business in an educational institute.

A.1302. When a man takes to medicine, he practises medicine, and a man who learns dentistry practises dentistry?—Before an engineer qualifies himself, he has got to put in five years in the workshops as a fitter.

A.1303. It would not apply to surgery, or medicine, or dentistry?—I do not think you can call an average doctor a business man.

A.1304. We have never yet been told why it is that these graduates from the agricultural colleges do not take to agriculture, or why they are not being employed by the big owners?—That applies to other countries also; I do not think, as a rule, a graduate of an agricultural college in Great Britain takes to practical farming.

A.1305. What is it that is special in agriculture, when those who learn it make more money by preaching it than by practising it? Where does the difference come in between agriculture and every other form of education?—Agriculture is purely empirical; any scientific work you learn should be a help, but it will not take the place of practical technique, and you can only learn your practical technique by the sweat of your brow.

A.1306. You have heard of the proposal in the Punjab to allot land to agricultural graduates for a period of years?—Yes, I have heard of it.

A.1307. Do you approve of it?—I think it would be a very interesting experiment.

A.1308. Do you think it would be sufficient to give the practical training required?—I think you would get a certain number of good men out of that lot.

A.1309. It would add to the value of the graduate?—I think it would.

A.1310. Do you think it is possible to standardise agricultural machinery such as ploughs to an extent which would permit of mass production? We have been told that if you could have half a dozen types of ploughs for India you might get a great reduction in the cost price by mass production; do you think it is possible?—I have a great hope in it; I think it is a development which will occur in the future.

A.1311. Do you think it will be possible?—I have great hopes about it.

A.1312. *Mr. Kamat*: You had the advantage of service in Sind; you have also visited Egypt, and you have had considerable experience at the Imperial Institute here. I should like to ask you, in view of this experience of yours, something about the possibilities of Sind. I do not wish to put any hypothetical questions, but I cannot resist the temptation of asking you for an expression of your opinion with regard to the future possibilities of Sind. Do you think, under an improved agricultural system, Sind will approximate in yield to Egypt, say, for a crop like cotton?—There are some very great disadvantages which Sind labours under. In the first place, it has got a very bad climate; its hot weather is probably one of the worst in the world; some parts of Sind have got an extremely bad type of malaria, and it seems it is getting worse.

A.1313. *Sir Ganga Ram*: Even worse than Bengal?—I think it is worse than Bengal. Another point is that you have got a very small population. I believe the population of Sind is about five millions and the area is about 40,000,000 acres. It is a very scattered country, and in most cases the soil is inclined to be impregnated with alkali or *kalar*; but provided the population difficulty is got over and you can get the right type of colonists into Sind, I should think it has got great possibilities. For one thing, it starts off with a great advantage; it has got excellent drainage; the subsoil water is very low. Egypt suffers very badly, because the subsoil water is high, and it has got the greatest difficulty in getting rid of this drainage water.

A.1314. *Mr. Kamat*: You are aware that the Bombay Government are making a huge experiment, from the financial point of view, in the shape of the Sukkur Barrage. Do you think that will help the Province of Sind in

improve matters and come up to the level of Egypt?—I am afraid it will take some considerable time. The difficulty, in my opinion, is the want of population.

A.1315. I want to take you to another general question which arises out of your remarks in the pamphlet* which you have placed in the hands of the members. While discussing the question of reclamation work and other work in Egypt and comparing it with similar work and its yield in the Punjab on page 9 you say, "It will only be by the adoption of suitable intensive rotations and the largely increased use of leguminous fodder crops and keeping and feeding increased numbers of livestock that the yields of irrigated land in North-West India will approximate more nearly to those in Egypt." You go on to say, "At present the average yields per acre in the Punjab canal colonies, especially on the older colonies, are very small and evidence seems to point to the fact that yields are decreasing." This is in comparison with Egypt. Do you still hold by that opinion?—Yes.

A.1316. This was written about 5 years ago. Are things improving or stationary, so far as your knowledge of the Punjab goes?—I think it still holds.

A.1317. Coming to your précis, you said you had only 2 graduates in your section receiving post-graduate training at the Imperial Institute here. Do you think matters could be improved?—We could train more if the Provinces sent us more students to train.

A.1318. Is it the difficulty that the Provinces do not send the students, or is it that your method of selection is defective?—The men we are training just now have been sent to us by the Provinces; they are members of the Provincial Service.

A.1319. *Professor Gangulee*: Out of how many applicants have you selected these 2?—Out of 3.

A.1320. *Mr. Kamat*: Does it not seem to you to be almost a tragedy that from a vast country like this there should be so few graduates coming up here, and that it reflects on the Imperial character of this department here?—The point is that if the educational facilities in the Province are so good, they do not need to send us men for training.

A.1321. Either the post-graduate training here must be carried on under more satisfactory circumstances, or it ought to cease, and the better course surely would be to have a larger number of graduates trained here. Have you not thought of the possibility of getting over this point, which perhaps has been due to methods of selection or some other consideration?—That does not apply, in my opinion. While this may not be a very suitable place from the agricultural point of view, from the point of view of other sections it may be a very suitable place. A man who wants post-graduate training, say, in entomology, is in quite a different position from the man who wants post-graduate training in agriculture.

A.1322. Have you any idea how many students go abroad to learn the same subjects which are taught here?—I have no information on that point at all.

A.1323. Are no figures collected?—No.

A.1324. Speaking about co-ordination, you have said that co-ordination between the Imperial Institute here and the Provinces varies from Province to Province. Where you thought such co-ordination to be lacking, have you ascertained its causes?—I do not think it is a case of lacking; people come to me if they think I can do them any good; if they do not believe I can do them any good, they do not come to me. I have given the example of Madras; they do not come to me on questions affecting agriculture, but they do come from other Provinces.

A.1325. In the case of Madras, for instance, when you say they do not come to you, have you ascertained the causes why they do not come to you?—Because they have got their own experts in Madras, who are probably

* Not printed: Notes on Practical Salt Land Reclamation—Bulletin No. 91 of 1920—by Mr. Henderson.

much better qualified to advise them than I am. I have no special experience of Madras; my special experience is in an entirely different direction.

A.1326. In that case, where for the time being, accidentally or otherwise, a situation like this arises, that is to say, an expert in the Province of Madras being as good an expert as at Pusa, there should be no complaint that there is not sufficient co-ordination, such a state of things is inevitable?—I do not know that there was a complaint.

A.1327. Then, in the case of those Provinces where the co-ordination is not as much as you wish, you have no complaint to make?—No.

A.1328. To come once again to this question of the administrative situation and your suggestion for revision of the position, I am not quite clear whether you have made the position clear or whether I quite follow you, in the light of the constitutional position of the country as it stands at present. Let us see how far we agree. You agree that as long as the Government of India Act stands as it is, agriculture must remain a Transferred subject in the Provinces and therefore the Province must be autonomous?—Yes.

A.1329. If that fundamental fact is accepted, the Government of India should have no right to interfere?—My opinion is that it should have no right to interfere with any domestic problem; but it should have the right to interfere where the problem is common to two or more Provinces.

A.1330. That is where we disagree. In any shape or in any form whatever, the two things are contradictory. If a subject is Transferred, constitutionally do you think it should remain in the hands of the Central Government even for purposes of the remotest point of interference?—I am afraid I cannot agree with you.

A.1331. Assuming that the Government of India should have no power of interference, should then the Pusa Institute have any power of interference, since the Institute is an advisory body either to the Central Government or to the Provincial Governments?—On broad lines my opinion is that it should have no power to interfere in a purely domestic problem. But when that problem ceases to be a domestic problem it certainly should have a right to interfere.

A.1332. In that case do you mean to say that a problem which is domestic in one Province and is also domestic in another Province becomes a central subject simply because it is common to two Provinces?—I do not follow you.

A.1333. You admit that a particular subject, say, a particular crop, is a domestic subject in one Province. It is also domestic in the adjoining Province. By mere virtue of the fact that the subject is common to two contiguous Provinces, does it become a central subject?—Yes.

A.1334. I think there again it does not seem to be perfectly clear; it is rather contradictory?—May I take a concrete point to illustrate my meaning? We might have a case where one Province was busy pushing out a certain type of cotton; this might be close to an area in a different Province where a very high class long staple cotton was being grown. By pushing this cotton out they might be radically injuring the good cotton and still, for political reasons, one Province might not be prepared to stop that cotton being pushed; that is a case where the Central Government should have power to come in and act.

A.1335. Yes, but act only in the shape of giving advice. But what you want is to go beyond the Government of India Act and invest the Central Government with powers of interference and initiative in certain matters which cut right across the very idea of the Government of India Act. Now about this proposal for revision of existing relations, there is some little contradiction in your suggestions. In one place you say, "It is hardly likely that the Government of India would ever interfere even in the remotest way with any purely domestic question in a Province." That is, you agree that so far as a purely domestic question is concerned, they should not interfere. But, in another place, in making suggestions on the lines on which the present administrative position should be revised you say, "The

Government of India must have a strong central executive body to co-ordinate and to advise on all questions of an agricultural nature in India." I cannot understand how a body could be executive and yet give only advice and co-ordination. If it is an executive body it will interfere?—A body of that nature would, I think, never interfere except in the case of absolute necessity.

A.1336. Now the question is, even in the case of absolute necessity, should it have, constitutionally, the power to interfere?—It seems to me that if it is going to be purely advisory, its functions may eventually be practically null and void.

A.1337. In which case would there be any harm in giving the Government of India power to interfere in the matter of Transferred subjects in the Provinces? Or would it be better to leave each Province to advance as it likes? Which would lead to the more chaotic state of affairs?—I might give a case in point. A lac institute has lately been established near Ranchi. In the course of time they will have a fully equipped Chemist and possibly a Botanist. Within a short distance of that there is an experimental station of the Agricultural Department. You might get two Botanists working within a few hundred yards of each other and doing work which one might do, and these cases will undoubtedly be multiplied in the future.

A.1338. I quite realise your difficulties and I quite realise also your desire. I do not wish you to misunderstand me. What we both desire is to have co-ordination and a machinery for co-ordination. But that machinery, I say, should be on the basis of advice on the part of the Central Government and in no case should it be in the form of actual interference; and, if you agree, then our task would be to suggest what sort of machinery these should be to secure better co-ordination. Now in order to achieve this end, that is to avoid interference, yet to have co-ordination we have been told in some other place that the only machinery possible under the present Act would be a Central Advisory Board in which your Institute should have an adequate place. Would you be satisfied with that?—I am afraid that would not be sufficient to fulfil the case.

A.1339. You do not then agree with Dr. Clouston's suggestion to have a Central Advisory Board to guide the Government of India and, through them, the Provinces? Would that be an adequate machinery for the kind of co-ordination which you desire?—I am afraid it would not.

A.1340. In what respect would such a Central Advisory Board fail?—We have had a good deal of experience with the Board of Agriculture which meets periodically. It is composed of representatives from all parts of India. It meets and passes resolutions.

A.1341. Supposing we get over that difficulty where the deliberations result purely in resolutions and we frame also a machinery to give effect to the resolutions of this Advisory Board, would you be satisfied? That is to say, there would be a permanent Secretariat attached to the Central Advisory Board and through the Secretariat a certain amount of correspondence would be carried on with the Provinces in order to ensure action being taken on the resolutions. Would that satisfy you?—The point is this. I am not in a position to argue with you on points of politics as you know them very much better than I do; I am an agriculturist. But it seems to me the most direct way is that the body which is going to be constituted should have executive powers.

Well then, we differ fundamentally, I am afraid.

A.1342. *Sir Henry Lawrence*: On the question of the development of Sind, you say that you foresee difficulty in securing enough labour for the land under the Sukkur Barrage and you give some figures as to the population of Sind and the area of Sind. I think you said 5 million of population and 40 million acres?—Yes.

A.1343. You do not suggest that the Sukkur Barrage is going to command the 40 million acres, do you?—No.

A.1344. The actual area commanded is $7\frac{1}{2}$ million acres, is it not?—Yes.

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A.1345. I think the actual figure of population in Sind is $3\frac{1}{2}$ millions and not 5 millions and about 2 millions would be living in that area?—Yes.

A.1346. Now can you tell me what is the amount of land cultivated per head of the population in other irrigated areas?—I cannot tell you off-hand. But it has been my experience that where you grow cotton, especially irrigated crops, you must have a fairly dense population.

A.1347. Will you agree that the area cultivated in places where cotton is grown is as high as $1\frac{1}{2}$ to 2 acres per head of the population?—I think it is about that.

A.1348. So that the population of two millions may be able to deal with the cultivation of 5 million acres? Would you like to think over that?—I think it is on the small side. 5 million acres is the actual area of Egypt and the population of Egypt is much more than 2 millions, I think.

A.1349. Then Mr. Kamat got an opinion from you that the produce of irrigated land in the Punjab was decreasing. Is that a necessary result of irrigation, or is it due to some bad methods of cultivation?—I think it is due largely to economic conditions. They are rather apt to take too much out of the land in the first instance before they have got sufficient cattle, and they do not grow sufficient leguminous crops. But I think on the whole it tends to even up later on when the country becomes more settled. I base that evidence on questions which I put during the Cotton Committee to various officers and zamindars in the Punjab: they said that in their opinion on the older canal colonies yields were decreasing, in some cases very slightly, but still on the downward grade.

A.1350. Did you carry that further and ascertain the cause?—I put the cause down to the fact that wheat was very largely grown and that fodder crops were not cultivated in sufficient ratio.

A.1351. So that you would ascribe it to an improper ratio of cotton and wheat without the land being heartened by leguminous crops?—That is the basic cause in my opinion.

A.1352. But supposing you had a proper rotation with leguminous crops, is there any reason why the produce should decrease?—If a proper rotation is carried out and a heavy stock of cattle carried, all experience tends to show that the fertility will increase.

A. 1353. So that you want two factors; you want both leguminous crops and a sufficient head of livestock?—Yes.

A.1354. In regard to Sind, are you aware of what experiments are being made or are in process to ascertain the proper rotation of crops?—A considerable amount of work has been done already in Sind on this subject. There is a station at Sukkur on what was formerly very poor land but is now growing excellent crops.

A.1355. Is that station still maintained?—Yes.

A.1356. Are the lessons taught by that station propagated? Do people know of them?—The difficulty is this. An intensive rotation of that nature means a supply of water sufficient to grow two crops a year, and the conditions under which you can get the supply of water are at present limited. On the Sukkur farm the water is obtained by pumping from the river, and thus it can be regulated; but in any of the existing canals in Sind the amount of water is fixed and you cannot get more than this fixed ratio, so that it is impossible to carry out a really intensive rotation, but they get over that by having a large number of fallows.

A.1357. I do not fully understand. Do you think there are sufficient experiments being made now in Sind to prepare the way for the Sukkur Barrage?—A new station has been started but I have not seen that yet, but there is quite a lot of data available as to the result of intensive rotations.

A.1358. From the Sukkur and the Mirpurkhas farms?—Yes, and also to a small extent at Larkana.

A.1359. Have you ever advocated any further experiments being made in advance of the Sukkur Barrage?—In the Report of the Cotton Com-

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mittee it is very definitely recommended that two such stations of at least 200 acres should be established.

A.1360. And what action has been taken on that?—One station has lately been sanctioned, but I believe they have already had difficulty about the water-supply, they put it in a place where it is not possible to get the water-supply as contemplated by the Indian Cotton Committee Report.

A.1361. Did you recommend any specific position for the other station?—No, we left that to the Local Government.

A.1362. *Sir Ganga Ram*: So that the experiment was not made?—The experiment has not yet been made.

A.1363. *Sir Henry Lawrence*: Is there any other situation that you know of in Sind where the water-supply is adequate?—The object was to reproduce post-barrage conditions, and that could have been reproduced by putting up pumps at certain selected sites on the river.

A.1364. And that is your recommendation?—That is the recommendation of the Indian Cotton Committee.

A.1365. Has that been communicated to the Bombay Government?—Undoubtedly, yes.

A.1366. But no action has been taken?—The action taken has been quite recently.

A.1367. But that is a different locality altogether?—Yes; our point in the Indian Cotton Committee was that it is essential to reproduce post-barrage conditions.

A.1368. In a recent meeting, I think of a scientific body, it was stated that the land in Sind was bound to deteriorate if it received heavy waterings; is that your opinion?—Who stated that?

A.1369. I think the President at a scientific meeting, Mr. Howard?—No, as the statement stands, it is not my opinion.

A.1370. What is the actual fact in your opinion?—Land can be damaged by heavy waterings if the water is improperly distributed; but the mere fact of putting heavy irrigation on land does not necessarily spoil it. Otherwise all rice land would be spoiled.

A.1371. *Sir Ganga Ram*: Does not heavy watering cause waterlogging?—It may, under certain conditions, but not necessarily.

A.1372. *Professor Gangulee*: It depends on the condition of the subsoil, does it not?—Yes.

A.1373. *Sir Henry Lawrence*: Did you find in Sind that the alkali there met with is soluble in water?—All the salt land of which I have had experience in Sind contained soluble alkali.

A.1374. And the irrigation can wash those salts down into the subsoil?—If you get sufficient irrigation you can wash it down into the subsoil.

A.1375. So that that is not a serious danger in your opinion?—It is a serious danger if there is not sufficient water; if there is sufficient water it is quite an easy proposition to wash the soluble alkali down into the subsoil in the case of Sind.

A.1376. Do you contemplate the establishment of a dairy industry in Sind?—I should think the dairy industry should be promoted by all possible means in Sind.

A.1377. I think you said that you were of opinion that a dairy industry would be of value to Sind?—Yes.

A.1378. Could you develop that a little more by giving grounds for it? At present in Sind there is a very good type of cattle called the Karachi breed. Do you expect that breed to spread to other parts of Sind?—I think when the canal becomes a going concern there will be a very big scope for dairying. It seems to me to be absolutely essential, on a canal of this nature, to have a large area of fodder crops and as there is an

excellent dairy breed in the Province, dairying and fodder growing will go hand in hand.

A.1379. Do you consider that the people there know how to treat their cattle properly?—My experience of the Karachi district is that the breeders are efficient.

A.1380. Do they understand the principles of breeding cattle?—In my opinion they do; and they also keep a note of the pedigree to a certain extent.

A.1381. That is a very rare fact in India?—Yes, it is.

A.1382. And do you see any other advantages that the dairy industry would have in Sind over other parts of India?—As the Province develops under irrigation you must keep up the fertility of the land, and it is necessary to increase the livestock population, otherwise I do not see how the fertility of the canal area can be kept up.

A.1383. In Sind would there be the same difficulties about the disposal of young male stock as is found in other parts?—I should think there would be a considerable demand for young male stock of good breed.

A.1384. Now to come to this question, which Mr. Calvert raised, of the use of Pusa to India: you have no experiments here in rice?—No.

A.1385. What is the reason for that?—It is not a rice country. We have really no rice land on the Estate.

A.1386. Is not rice grown a good deal in this Province?—More south of the river and in patches north of the river.

A.1387. So that for reasons of soil and climate you have not been able to carry out rice experiments. Pusa is not suited for the purpose?—No.

A.1388. Rice is the most important crop in India?—Yes.

A.1389. The next most important is millets. Is that so?—Yes.

A.1390. Have you had any experiments on millets?—Yes, we have grown practically all the standard millets, and we have had them on small and large areas.

A.1391. Have you been able to devise any method of improving the millet cultivation?—We have not done very much work on millets. It is not the staple crop in this district.

A.1392. From that point of view again Pusa is not suitable?—No.

A.1393. Not suitable to the most important agricultural interests in India?—That is so.

A.1394. It is not because you were induced to favour export crops, the money crops, rather than the crops of internal consumption?—No; we have naturally taken up work on the crops which are indigenous to the tract to begin with.

A.1395. In regard to your visits to Provinces you say you have been welcomed in some places and not welcomed in others. Do you wait to be invited to go to a Province or do you announce your intention of visiting a Province?—Under the present Accounts Rules you have got to be invited practically.

A.1396. What Account Rule is that?—The Accountant-General puts difficulties in the way of passing any travelling allowance bill unless there is a very clear reason for going to a district.

A.1397. Which Accountant-General is that?—The Accountant-General, Central Revenues.

A.1398. And has that position of the Accountant-General ever been disputed?—I shall have to refer you to Dr. Clouston on that point.

A.1399. Since when has this objection been taken?—Within the last two years.

A.1400. Actually have your travelling allowance bills been refused by the Accountant-General for want of a specific invitation from a Provin-

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cial Government?—I will not go so far as to say that, but great difficulties have been created and questions have been put.

A.1401. In regard to experiments in cattle-breeding, you have tried crossing the local cattle with Ayrshire bulls. Have you obtained any other imported bulls?—We have had a limited number of American Friesian crosses but the majority of the crosses have been got by the Ayrshire.

A.1402. And the result of the first cross is very good in regard to milk supply?—Uniformly good.

A.1403. Continued crossing with the same Ayrshire, or foreign breed did not prove satisfactory?—That is so.

A.1404. Have you tried the further scheme of crossing with this year first cross-bred, the Sindhi, Montgomery or other Indian cattle?—We are now beginning on that work.

A.1405. You have not arrived at any conclusion yet?—As far as we have gone the results have been very satisfactory.

A.1406. That is quite a promising experiment. Has not that been tried in any other part of India?—I do not think it has been tried systematically on any large scale.

A.1407. Have you any knowledge of the experiments made by Mr. Borden in Texas, in connection with the importation of Indian cattle for the improvement of Texas cattle?—I have heard about them, but I have no personal experience. I am told they have proved quite satisfactory with regard to resistance to tick fever.

A.1408. That is to say, the quality is imported by the Indian sire and subsequently continued in the stock though the subsequent pedigree was entirely local. Does that not offer some hope for similar results in this country?—I think there is a promising field for that work but it must be done on a fairly large scale and there must be continuity of policy.

A.1409. Have you any knowledge of the milk question in Madras?—I have no first-hand information.

A.1410. Do you know that Madras milkmen attach considerable value to English blood in their milch cattle?—I have been told so.

A.1411. You have not had any opportunity of investigating it?—No first-hand knowledge.

A.1412. You showed us this morning some soya bean growing. Has that crop been successful in other parts of India?—Only as a fodder crop, not as an oil crop.

A.1413. Has it been grown for oil-seeds anywhere?—Only on a limited scale, as far as my information goes.

A.1414. Does it produce much seed?—Not a very big yield.

A.1415. But merely from the point of view of fodder it is worth growing?—It is very valuable in this place because it fills up the gap between maize and clover.

A.1416. During what months?—September and a part of October.

A.1417. For how long do you leave it in the ground?—It is sown during a break of the rains and is grazed in September and October.

A.1418. That is to say it is 4 months in the ground. How many grazings do you get from it?—Only one.

A.1419. *Sir Ganga Ram*: How long have you been in Sind?—I went there in the beginning of 1907 and left in 1916.

A.1420. In what capacity?—As Deputy Director of Agriculture.

A.1421. Do you know that the total population of Sind is only 3½ millions?—I thought it was a little more.

A.1422. It may be a little more. During the last census it was 3½ millions and already they have got .93 acre per head of the irrigated area. In fact as regards the percentage of irrigated area they stand at

the top of India?—That is so because you cannot cultivate without irrigation.

A.1423. I mean irrigated area without the Sukkur Barrage. Do you know anything about the qualities of the peasantry of Sind? Are they good peasants?—Not particularly good cultivators.

A.1424. For how many working class people is the area already irrigated sufficient?—I should say that the great majority of the people are directly connected with the land.

A.1425. What I mean to say is that you may safely say one million will belong to the cultivating class so that for one million you have already got one million irrigated acres. Do you think that the people want more?—I take it the idea is to colonise and that the new works bring in colonists from other Provinces.

A.1426. Is that the idea?—I think so.

A.1427. Have you made any research as to the delta of water required to mature each crop?—I have had a certain amount of experience.

A.1428. Could you give me a list of those experiences?—Yes, I will send it to you.

A.1429. Have you made any experiments as to what each crop takes away from the soil and what each crop gives back to the soil in chemical properties?—No, not absolute chemical properties, but I have to a certain extent judging by the state of the succeeding crop.

A.1430. You have not made any regular analysis after the crop is cut?—We have never had a Chemist in Sind.

A.1431. For want of staff?—Yes. There is only one Deputy Director of Agriculture in Sind.

A.1432. You say in your note that after sugarcane you sow maize. Is that the proper rotation?—That is proved by the result.

A.1433. Did you try cotton after sugarcane?—This is not a cotton tract. I grow cotton occasionally.

A.1434. What is there against cotton?—The rainfall is very heavy.

A.1435. What is the area of your Pusa Estate?—The arable area is about 600 acres.

A.1436. And you think that a little irrigation will not improve prospects of research?—We have a certain amount of irrigation which you saw this morning but the main portion of the farm is not irrigated because the land generally in North Bihar is not irrigated, and if we get results from irrigation these would not apply to Bihar.

A.1437. Have you got a contour plan of your estate?—Yes.

A.1438. Can you send it to me?—Yes.

A.1439. I should also like to have any experiences that you may have in regard to the chemical properties, *plus* or *minus*, of your crops?—My colleague Dr. Harrison would be able to give you first-hand information on that.

A.1440. Perhaps you may make a note of that also?—Very well.

A.1441. Do you know the discharge of this river which goes through your Estate?—No, I do not know its discharge.

A.1442. What is the source of this river?—It comes from a big lake up in Nepal.

A.1443. Have the Canal Department ever considered the possibility of making use of it for irrigation purposes?—I do not think it is a feasible proposition because it varies so much. It floods very large areas during part of the year.

A.1444. What is your difficulty in the winter season when the rains stop?—It would have to be lifted.

A.1445. Is it not a fact that in this area round about this river you are generally free from famine, but sometimes on account of the stoppage

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of rain you are confronted with famine?—I do not think we have ever been confronted with famine in this district.

A.1446. Is there any fall here? Is there any possibility of preparing a hydro-electric scheme?—The fall is very small indeed. It is so small that when the Ganges is flooded this river is headed up and it floods miles and miles of the country.

A.1447. Where is the fall?—Between this river and the Ganges.

A.1448. Do you know the velocity of this river or at least the fall in the river?—I have got no data on the subject. It is very small indeed. We are only about 60 feet above Calcutta level here.

A.1449. You said in your evidence that people eating *juar* would not take *bajri*, but the two things are grown in separate seasons. In Bombay they grow *juar* in the *rabi* season also?—My evidence applied solely to Sind.

A.1450. Not to Bombay?—No. I was talking about *kharij juar*.

A.1451. In Sind they do not grow *rabi juar*?—No.

A.1452. You recommend that Pusa wheat might be spread all over India. Have you any knowledge of the Punjab wheat which has now superseded Pusa wheat?—I have seen the different varieties grown at Lyallpur.

A.1453. Do you know that Punjab 8A is a better quality?—It depends.

A.1454. May I tell you the defect in Pusa wheat? It is not a very hard wheat for milling purposes and that is the reason why our 8A is very largely demanded; it is hard and just the quality for milling purposes?—Pusa 12 was a preliminary wheat. Quite a number of wheats are now coming on.

A.1455. Are they better than Pusa 12?—Yes.

A.1456. Have you ascertained any method of fixation of nitrogen from the air?—Yes, by means of leguminous crops.

A.1457. Anything else?—No.

A.1458. Not by very frequent ploughing?—No.

A.1459. Has not that led to fixation of nitrogen?—That I am not in a position to give an opinion on.

A.1460. How many times do you plough here for your crops?—For the *kharij* crops it all depends on various conditions; but we make it a rule to plough at least to 9 inches once in a year.

A.1461. Have you any section of the subsoil here?—Dr. Harrison has got that.

A.1462. Will you kindly make a note of that too?—Yes.

A.1463. In your written note you say there are 16 million acres under wells in the whole of India?—Yes.

A.1464. Have you any opinion to express on the necessity of grain elevators?—I should think they are absolutely bound to come sooner or later.

A.1465. Did you have any experience of them overseas?—I have seen them in Canada.

A.1466. How far apart are they?—There are elevators practically at every chief station on the railways.

A.1467. What I want to ask is whether the distance of carrying will not outweigh the advantages of the elevator? How far apart are they?—My recollection is that there are elevators at every station and these stations are probably 10 miles apart.

A.1468. Have you any experience of dry farming?—I have seen the dry farm stations in Texas.

A.1469. Is dry farming conducted because there is no rain?—Yes, there is very little rain. They do dry farming with a rainfall of under 10 inches.

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A.1470. In parts of the Punjab where there is a rainfall of only 8 inches or 6 inches, do you think dry farming ought to be adopted?—You mean on *barani* tracts?

A.1471. Of course; there is no irrigation?—10 inches is the rainfall in Texas during the 12 months, whereas your rainfall is probably in a couple of months.

A.1472. Do they have rain throughout the year?—Yes.

A.1473. Does not dry farming require deep ploughing?—It requires very careful soil protection.

A.1474. Is not ploughing essential for getting good results from dry farming?—It has got to be deep ploughed at the proper time, otherwise you can do a lot of damage.

A.1475. For dry farming you will have to discover a particular kind of seed?—They have got special varieties of seed.

A.1476. Has any research been made in that direction in India?—There has been a certain amount of research. Professor Knight in Poona brought out a large number of American *juars* and tried them at Manjri in Poona.

A.1477. No dry farming experiment has been made in wheat?—They have got some wheat varieties.

A.1478. In America they grow wheat under dry farming?—Some of this dry farming has been done in India also at various times.

A.1479. You do not go in for fruit culture in Pusa?—We do.

A.1480. What do you grow?—We grow peaches.

A.1481. Do you make any researches on that?—Yes; a lot of work has been done by the Botanical Section.

A.1482. *Sir Thomas Middleton*: What proportion of your own time is spent in Pusa and what part of it in touring?—Since I came to Pusa I have been on deputation, study leave and touring for more than half of my time.

A.1483. Are your touring duties mainly made for advisory purposes?—Yes, chiefly for advisory purposes.

A.1484. To what extent does your association with the supervision of Pusa assist you in these advisory duties?—It assists me very considerably.

A.1485. Your previous experience was entirely in Sind?—And also in Egypt.

A.1486. You do find that the work at Pusa is of great value to you when you undertake advisory duties?—Undoubtedly.

A.1487. You suggest that there should be other research institutes similar to Pusa in various parts of India. Your first criticism of Pusa was that it was a single station whereas there ought to be several institutes. Had you any definite places in your mind when you made that suggestion?—I would certainly have one place in a centre where irrigation is practised, another centre representing Southern India, another centre representing Bengal conditions and possibly a centre in Central India.

A.1488. That will make four. Were you thinking of stations as extensive as Pusa itself or of smaller stations?—I was thinking of sub-stations.

A.1489. Assuming that for financial reasons one has got to be contented with a single central station, do you think you could find a better centre than Pusa?—If Pusa were abolished that would mean the loss of a tremendous amount of capital that is involved.

A.1490. I was not thinking of abolishing Pusa. You said you could much improve upon Pusa?—I think one could get a centre which is more typical of varying conditions.

A.1491. So far as I have heard, the chief drawbacks of Pusa seem to be the crossing of the Ganges and the metre gauge railway. If you take the quality of the soil of Pusa from the point of view of an experimentalist, what would you say about it?—It is of a very special type.

A.1492. These experimental plots of yours are extremely uniform; are they not?—Yes, comparatively so.

A.1493. If you were to compare the soil you have for experimental purposes at Pusa with the soil of the farm of the college from which you came, which would you say had the better conditions? You remember the Holmes Farm?—When I knew the Holmes Farm, the soil was very far from being uniform.

A.1494. Have you seen other experimental farms in Britain?—I have seen the Craibstone Farm in Aberdeen.

A.1495. I think you will find Pusa soil much more uniform than that at other experimental stations?—Yes, I have seen a number of American experimental stations.

A.1496. I have not seen any American stations. I am comparing experimental areas in Britain with your fields here. What place does the farming of the Pusa Estate take in comparison with other Indian districts; does it take a very high place?—I should think, on the whole, it has a very high place, it is very intensively cultivated.

A.1497. That is how it struck me in looking at it for the first time. It is, perhaps with one exception, the most highly cultivated area I have seen. Does not that seem to suggest that it is naturally a suitable centre for experimental work?—It has very many advantages, but in my opinion it is too specialised to be the one and only station.

A.1498. And you would correct that by establishing sub-stations?—Yes.

A.1499. We can see that in one respect it was unsuitable; you cannot work on the rice crop here. In reply to Sir Henry Lawrence, you indicated that your reason for not experimenting on millets was that the crop was not of local importance; but there is nothing in the soil which prevents you from taking millet culture up if you wish to?—The only point is the very high rainfall and the difficulty sometimes occurs, when you get an early rainfall, in not being able to cultivate later on.

A.1500. Apart from the 70 acres which you have under experiment, the produce of the rest of the 600 acres goes to the cattle. It is essentially a cattle farm?—Yes.

A.1501. And your cattle stock is very high, as judged from British standards. What are the reasons for the policy in concentrating on cattle?—The point is this; barring 200 acres, the rest of the farm is liable to severe flooding. I have seen even the College grounds a sheet of water.

A.1502. *Professor Gangulee*: Is that very frequent?—No, it is not very frequent; it occurs probably every third or fourth year.

A.1503. *Sir Thomas Middleton*: Your answer is that cattle farming is really the most suitable commercial line?—Undoubtedly.

A.1504. You do not think that a greater amount of mixed farming and the sale of cereals would pay you?—The trouble is the uncertainty of the season. This year, for example, we have had very little moisture; if we had grown any large area of wheat, for example, our produce would have been very low, but we do grow a large area of sugarcane on the farm.

A.1505. In taking up cattle to what extent were you influenced by the necessity for demonstrating the effects of selection of cows on milk production?—It seemed to be a problem which was of national importance and a fitting subject to be taken up at Pusa.

A.1506. What I want to ascertain is whether you went into cattle farming because the local conditions made it the most profitable type of farming, or whether you definitely aimed at demonstrating the effects of selection on milk production?—A certain amount of both.

A.1507. Your own work has shown that when properly fed, and selected with a reasonable amount of judgment, Montgomery cattle can be improved very rapidly; you have more than doubled the yield of milk in 12 years. Would you suppose that if similar methods were adopted for a number

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of Indian breeds you would get similar results?—There is the very outstanding result which was attained on the Surat farm by selecting Kankrej cattle. The Kankrej is a typical draught breed and is supposed to be only able to suckle its calf. After some years of careful selection on the Surat farm the Agricultural Department got cows giving 3,000 lbs. of milk.

A.1508. Can you tell me whether, in that case, the improvement was attributed to the regular feeding, or to the breeding?—I should think it was a case of feeding and selection.

A.1509. Just as in your own case?—Yes.

A.1510. Do you yourself attribute the success you have met with more to the regular feeding than to the selection, or is it the other way about?—I attribute it more to the feeding.

A.1511. *Sir Henry Lawrence*: What quantity of milk did the cows start from?—They were merely a selection from the Charodi farm; some probably gave 500 lbs. or 600 lbs.; it was under 1,000 lbs.

A.1512. *Sir Thomas Middleton*: Would you agree that it is of little use trying to provide superior bulls for breeding in India until the cows are better attended to and better fed?—Generally, yes; but in some tracts the cows are attended to.

A.1513. But in those cases in which the cows are neglected, it is really a waste of time and effort?—It is a waste of time. May I tell you of a case bearing on this point? I had to buy some Hansi Hissar cattle for Mauritius, and on the way down, while crossing the *ghat* one young bull got away and settled down in a village. We sent to that village and asked them to give the bull back and they refused. They said that the bull had come along of its own accord and they wanted to keep it. My Superintendent went along with some policemen and got it back by force, but the villagers followed them all the way to the station and offered Rs. 100 if they would let them have the bull. That is a case in point which shows that good bulls are appreciated.

A.1514. But those villagers presumably were looking after their cows carefully as in some districts they do; I can hardly think they would have followed your Superintendent and policemen if they had not been intent upon improving their cattle?—That is so.

A.1515. From the experimental work that is being done in India, you know almost exactly what the feeding of the cow ought to be in different districts. Has there been much propaganda?—It is only very recently that Livestock Experts have been appointed in the various Provinces, and I think it is quite safe to say that the propaganda work in most Provinces is now being carried on very strongly.

A.1516. *Dr. Hyder*: You attended the Conference held at Rome?—Yes.

A.1517. Do you think India is getting an adequate return for the contribution it makes to the funds of that Institute?—The contribution at present is very small; it amounts to about £800, and I think India is getting full value for £800.

A.1518. Could we make better use of the facilities provided by that Institute?—I think we could, if we could get a representative on the permanent Committee.

A.1519. Would you like that a member of your service, or a civilian who was about to retire, should be permanently at the Institute?—I should think it would be of the greatest advantage.

A.1520. Coming to Egypt, I find from the paper you have submitted that the reclamation of alkaline land in Egypt has been a success. We started level with the Egyptians in this matter; the Egyptians started work in 1888 and we started in about the same year. Why is it that the Egyptians have gone ahead of us? Is it due to lack of knowledge or lack of funds on our part?—I think the main reason is purely a financial one. When land in Egypt is reclaimed, it is of very great value. I stated that on Lake Aboukir near Alexandria, land which at one time was absolutely

useless has been sold at £150 a *feddan*, that is practically an acre; it is agricultural land.

A.1521. £150 Egyptian?—Yes.

A.1522. So that, in course of time, you think that when the value of other land rises, this question of the reclamation of *usar* soil will solve itself?—I should think it is purely a commercial proposition. If the water is available, it is not a difficult proposition.

A.1523. Let us come to Sind. Have you any knowledge of the early efforts at colonisation made in the Punjab?—Not first hand; I had heard a lot from Sir Thomas Ward.

A.1524. Are you aware that the Punjabis were averse to going to the Crown lands irrigated from these canals? But when they had been shown the way, every Punjabi flocked to the colony, but not before that. Do you not think that the Sindhis, when they see that more money can be obtained out of it, will make greater use of the facilities provided by the Sukkur Barrage?—I think, in course of time, they certainly will.

A.1525. Would you make a distinction between a seasonal migration of labour and permanent colonisation from other parts of India in a particular Province?—Undoubtedly. You have got both cases in Sind at the present moment. You have got quite a number of Punjabi colonists who come down and settle there, and you have the seasonal migration from Rajputana, the Tharis and Marwaris. They come in every season for cotton picking, make a bit of money and go back again.

A.1526. So that, this matter of the shortage of labour in Sind will solve itself, when the wages of labour go up in Sind?—The wages are comparatively quite good at present.

A.1527. And there is a seasonal migration of labour to obtain those better wages?—Yes.

A.1528. Can you give me concrete instances of agricultural matters in regard to which you wish the Central Government to retain the initiative in its own hands?—Take the case of export crops, the grading of export crops.

A.1529. I was wondering whether you were aware that that was not given over to the Provinces?—I was not aware of it.

A.1530. Can you give me another instance in which you desire the Central Government's initiative?—Livestock work, compilation of Herd books.

A.1531. I want you to be specific about livestock work. What is it that you desire the Central Government to retain?—Take the case of Gir cattle. They are rapidly disappearing. We want records, we want information regarding Gir cattle.

A.1532. Do you not think these are matters which are better left to the Provincial Government concerned?—Where you have got a breed which spreads over a number of Provinces I think it is sounder policy for the Central Government to take it over.

A.1533. *Sir Henry Lawrence*: Does the Gir breed of cattle concern a number of Provinces?—No; that is not a particularly good example.

A.1534. *Dr. Hyder*: What is this disappearance due to, exportation to other parts?—No; not so much exportation as mixture. These breeds must have originated in isolated tracts where there was little communication with the surrounding districts, and when communications improve deterioration sets in in many cases.

A.1535. Would you give any further instance?—Take the red Karachi cattle. That is a breed which has been proved to be suitable for all tropical countries.

A.1536. You think these are matters of sufficient importance for central initiative?—I think so.

A.1537. *Sir Henry Lawrence*: Is the red Karachi breed exported abroad?—Yes, a lot; to Straits Settlements, to Mauritius and so on.

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A.1538. Is there any danger of the breed being depleted?—I think there is a danger. One of the recruiting grounds for the red Karachi cattle is outside British India altogether.

A.1539. *Dr. Hyder*: You want Pusa to branch out into the Provinces, that is, you want to have stations in the different Provinces. How are you going to establish connection between these different branches and the Provincial agency working in the Provinces?—That is already being done in the case of Bangalore, and in the case of the sugar station at Coimbatore.

A.1540. You think there is intimate connection between these Imperial stations in the Provinces and the Provincial Departments of Agriculture?—I believe so.

A.1541. Is it a fact that provincial officers do not desire the advice of Pusa because they think, "We are men with the same education, with the same qualifications and further we are men on the spot; we have better knowledge than somebody coming from far off"?—I have not come across much of this feeling. I think the man in the Province, if he is of the opinion that he can get advice on specific subjects at Pusa, has no hesitation in coming to Pusa for advice.

A.1542. To proceed to another matter, the export of bone and oil-cake. Would you make any distinction between these two?—With regard to bones I do not see under the present conditions any great advantage in restricting their export. If we had large supplies of sulphuric acid it would be different. In regard to cake, I do not see that conditions are favourable at present for putting any restriction on the export.

A.1543. But the chemical substances in the case of bones are irreplaceable and in the case of oil-seeds they are replaceable, is not that a serious matter?—I do not think it is a good policy to interfere with the export.

A.1544. You think it is a good thing that the oil-seeds should go to France and other countries and they should not go to parts within the British Empire?—It seems to me it is purely a case of supply and demand. They must follow the market. If you interfere with free trade in things like that the results might be harmful.

A.1545. You do not think you can have these oil-seeds crushed here, export the oil and retain the cake?—That trade is gradually increasing, I think in course of time it will be complete.

A.1546. With regard to bonemeal do you not get it returned to you in the form of sugar from Java? They use it as manure in Java and that gives extra yield of sugarcane and the surplus sugar comes back to India; is not that a serious matter?—The same applies to sulphate of ammonia. It is going to Java too.

A.1547. *Sir Ganga Ram*: Sulphate of ammonia does not go from India?—I think a certain amount of it goes.

A.1548. *Dr. Hyder*: You spoke about rice-hulling machinery. Is that taken up by the small man or by factories?—By merchants.

A.1549. Then with regard to cowdung being used as fuel, how do you think this matter will solve itself if left alone?—It seems to be an extraordinarily difficult thing to deal with and I think the matter has been overdone really. A lot of cowdung is naturally deposited on roads, *bunds* and grazing areas. It is dried up almost at once and people must have fuel.

A.1550. With regard to the drying up of cowdung and its waste, do you not think all these are different manifestations of a very wasteful system of agriculture?—It seems to me that is part and parcel of a wasteful method of grazing. Instead of growing fodder crops cattle are put on to extremely indifferent grazing. Manure is wasted if they are allowed to remain in the grazing ground.

A.1551. To improve the cattle you have got to have them in enclosures, would that be a good thing?—I do not think it is necessary to have them in enclosures.

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A.1552. With regard to the question of marketing of wheat you are familiar with the conditions in Sind and Karachi. Is it true that the trade is against the introduction of elevators on account of the fact that, in unloading, the wheat acquires a little extra moisture and that gives a little extra weight?—I believe that is one of the reasons.

A.1553. *Sir Ganga Ram*: You gave some reasons why the Punjab yield is decreasing. Is it not due to fragmentation and want of consolidation?—I think that is one of the reasons.

A.1554. That is a very important reason. As we go along we find that fragmentation is increasing and consolidation of holdings is necessary?—Yes.

A.1555. Have you any experiments on hydrogenation of oil so as to make it more fit for export and also for its being used as grease for railway wagons?—No; I have not made any experiments.

A.1556. You refer in your note to the dirty wheat of India. Whom do you blame for producing the dirty wheat and for sending the dirty wheat to London?—I do not blame anyone; I merely mention the fact.

A.1557. Do you think the zamindars do it?—They do it a little bit.

A.1558. These exporters do it; I can prove it. I can give you a concrete example. These exporters offered me Rs. 5-8 for my wheat; I did not accept it and the middleman came to me and he paid Rs. 5-12 and then sold it to them for Rs. 5-8 and it was sent to the London market. I have seen it with my own eyes?—I do not deny that a bit, but the wheat as it comes from the zamindar is not clean.

A.1559. I can tell you how it could be avoided. It would be avoided if they gave the rate of pure wheat and quoted the discount afterwards; but they go to the other way; they quote for dirty wheat and it pays the middlemen to make the wheat dirty?—It may be so.

A.1560. In one of the answers you say that you advocate two crops in a year?—Yes, under certain conditions.

A.1561. What two crops?—A fodder crop and a grain crop if possible.

A.1562. Do you know that cotton has a peculiarity of growing on alkaline land?—Yes, it does grow very well on such land in some cases.

A.1563. That is why in Egypt you have succeeded in reclaiming the soil?—Yes.

A.1564. You were on the Committee dealing with the reclamation of barren land?—Yes.

A.1565. Can you tell me whether, if this rank grass and reeds which grow abundantly on the banks of canals were put into silos, it would be fit for cattle to eat during famine or scarcity?—My experience of siloing grasses and coarse fodder is that it does improve them, but you cannot get a first class silage unless you put in a first class raw material.

A.1566. Did you experiment as to converting the rank grass on the banks of canals into edible fodder?—I have seen that done and the result was quite favourable; but it was not a high class silage; it was only fit for starving cattle.

A.1567. But at the present time it is regarded as waste material and is burned. In your opinion would it be desirable to keep it with a view to the possibility of any scarcity of fodder?—Yes, I think it would be a very sound thing.

A.1568. You are aware of the fact that we do not grow sufficient potatoes for the needs of the country?—I think the potato crop is one which requires a considerable amount of investigation; that is one crop that the Imperial Government might take up.

A.1569. That is a very important question?—Yes, it is.

A.1570. At present we are importing from Italy and other countries?—For seed.

A.1571. We also import for consumption. Do potatoes grown from Italian seed give good results?—The seed gives very good results; a certain

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amount comes to Karachi and a certain amount to Bombay; it is grown near Poona and the seed goes further south to Madras.

A.1572. Are you aware that we do not grow sufficient onions for our own consumption?—I should think that is another promising line of investigation.

A.1573. I know that in the Punjab for 6 months the people eat imported onions, because our potatoes mature in April and if they are kept they begin to shoot after being kept 6 months. Have you made any experiments as to making use of blood from slaughter houses?—No, but it has been done at Poona.

A.1574. For purposes of manure?—Yes, on cane.

A.1575. Is there any literature on that subject?—I think it is mentioned in one of the Poona reports; the work, as far as I remember, was done by Mr. Knight.

A.1576. Because, a very large quantity is exported from Bombay to Hamburg?—Yes. I want to say to Mr. Kamat that when I told him that there were two post-graduate students under training I was wrong; there are three. Post-graduate training at Pusa qualifies a man for the highest posts in the Agricultural Service; but the number of posts for Chemists, Agriculturists, Entomologists, Botanists, etc., does not average one per year for each subject.

A.1577. *Mr. Calvert*: That is, Government posts?—Yes. And that one post when it falls vacant is sometimes given to a local man who has worked his way up. This is done in some cases for political reasons. There are dozens of Indians who have been through Home agricultural colleges and in various parts abroad, and a large number of these men are still on the unemployment list; there is no vacancy for them in Government service.

A.1578. *Sir Thomas Middleton*: That is why you do not have many applicants for training?—That is one of the reasons. There are three and not two post-graduates; one was selected by the Central Provinces Government and sent direct.

A.1579. *Professor Gangulee*: How do you employ these three post-graduate students; what sort of training do you give them?—They come to me for two months to begin with, on the farm.

A.1580. Actually doing the farm work?—Yes. Then they go to the dairy side and do some dairy work; after that they go to the botanical area and Dr. Shaw gives them a course of lectures. They go round all the sections and then come back to me again for final examination.

A.1581. How many post-graduate students have already passed out of your hands?—In all we have turned out somewhere about 80. Some of these of course are not post-graduates. We have trained about 80 in the Agricultural Section.

A.1582. And most of them are employed?—I should think a large number of them are employed.

A.1583. With the equipment and staff your section has, how many post-graduate students would you be able to train per year?—With the present staff and equipment 3 or 4 a year.

A.1584. Do you think this post-graduate training is unpopular?—It is not popular at present because the men who might come here see no prospects in front of them.

A.1585. Would you agree that one way of attracting post-graduate students to Pusa would be to affiliate the Institute to a University and give a degree?—I am really not in a position to answer that. From the agricultural point of view I certainly would not recommend that.

A.1586. Do you supply seed of various crops to different provincial departments?—Yes.

A.1587. And to cultivators?—Yes.

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A.1588. Which seeds are in demand?—We supply a very large amount of sugarcane setts and a large weight of oats.

A.1589. Is that the new variety of Scotch oats?—No, we are not giving that out yet; we only give out thoroughly tested varieties. Then the Botanical Section supplies large quantities of wheat.

A.1590. Have you facilities here in the Institute for ascertaining the vitality and purity of seeds which you distribute?—Yes; Dr. Shaw will show you all that to-morrow.

A.1591. I find the total quantity of seed distributed in the year 1922 was 1,775 maunds, whereas in 1923 it was 17 maunds?—That was because cane was brought in, and the returns were not for 12 months.

A.1592. This figure of 17 maunds is only with reference to part of the time?—Yes; the other cane distribution overlapped.

A.1593. You must admit that that figure as it appears without explanation is very confusing?—A note ought to have been added.

A.1594. *Mr. Kamat*: With reference to your visit to Rome in connection with the International Institute there, in your Report you state that although the Government of India have held up, pending the Report of this Royal Commission, the appointment of a permanent delegate on behalf of India to that Institute, you suggest that a temporary delegate should be nominated and sent to Rome. I find from the proceedings of this Board of Agriculture that Mr. Strickland has submitted a note on this very same subject, and he states therein that the delegate on behalf of India should have a knowledge of the French language and preferably of the Italian language as well. Do you agree?—Yes, I think a knowledge of French and Italian would be a very great advantage.

A.1595. He also suggests that the delegate should have an assistant, because single handed he would not be able to do much work, and that it would be a great advantage if the assistant had a knowledge of the German language?—I myself think that is hardly necessary at a preliminary stage.

A.1596. If your proposals to have a temporary delegate sent to Rome were to be accepted, either by this Commission for recommendation to the Government of India, or by the Government of India direct, do you not think it would be an advantage to secure as delegate one who knew both the Italian and German languages?—My personal opinion is that a knowledge of French is essential; a man who knows French, will very soon pick up Italian, especially if he is living in Rome; I do not think he needs to know Italian before he goes to Rome.

A.1597. In the Agricultural Service have you a man who combines the necessary expert knowledge with a knowledge of these one or two languages?—Practically all the members of the Imperial Service are supposed to have a knowledge of French.

A.1598. *Mr. Calvert*: I think you told one of my colleagues that you thought elevators were bound to come?—Yes.

A.1599. Was that remark based on the assumption that the export of wheat would increase?—Yes.

A.1600. At present as you know the tendency to work on the land is more on the decline?—But in view of the very big extension of canals both in the Punjab and in Sind I should think there will be a very big quantity of wheat available for export.

A.1601. But during the last 25 years in spite of the enormous progress and extension that has taken place the results do not bear out that idea. There was no increased export of wheat?—But I am told that there will be a considerable export from Sind alone. Sind at present is not a wheat-eating tract.

A.1602. *The Chairman*: Have you knowledge of Egyptian agriculture in the course of your experience?—Yes, I have a certain amount of experience. I was there for about 3 years.

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A.1603. Is the Government of India responsible for any research into irrigation problems at this moment?—It is not carrying on any work.

A.1604. Do you think the Government of India might very well make itself responsible for research problems of a fundamental nature?—I think it is very important indeed.

(The witness withdrew.)

Mr. WYNNE SAYER, B.A., Secretary, Sugar Bureau, Pusa.

Replies to the Questionnaire.

Introduction.—I have devoted the last 8 years of my service in India to work on sugarcane both on the cultivation and the manufacturing sides. I have had the privilege of visiting Java and examining at first hand the actual working of the splendid organisation working there for the improvement of the sugar industry and have also recently studied the measures being taken for the development of the beet sugar industry in England. In my replies to the Questionnaire, I will therefore confine myself principally to the measures to be taken for the development of the Indian sugarcane industry in respect of both *gur* and sugar manufacture.

QUESTION 1.—(a) I consider it essential that all work on cane should be pooled and carried on under a small committee whose composition is given in Appendix I. We should then have the local knowledge of all workers in the Provinces and the technical experience of the specialist staff available for any problem which might come up. As cane does not respect provincial boundaries it is frequently the case that an improvement introduced into one Province is suitable for a tract in another Province. A committee of the type proposed by me will be able to correlate the work, make accumulated experience available to the Provinces and prevent any unnecessary overlapping. Sugarcane being a crop which is under cultivation in almost all the Provinces of India, it is in the fitness of things that the Government of India should supplement the efforts being made in the Provinces by providing for research and experiment which will be of benefit to all Provinces and which is beyond the means of any single Province either to initiate or to maintain.

Further, India has annually between two millions and a half and three million acres under cane (statistics for last 5 years given in Appendix II). India's imports of sugar from abroad are nearly 720,000 tons valued at roughly 15 crores of rupees (last five years' figures as compared with 1913-14 given in Appendix III) and as the Government of India levy an important duty yielding a revenue of about 5 crores which falls as an indirect tax on the consumers, the industry as well as the general public naturally expect that they shall not continue to be taxed indefinitely for an essential article of food like sugar when with adequate provision for research and experiment and propaganda the country itself can meet its own requirements and can thus put an end to the drain of 15 crores of rupees a year now spent on foreign sugar.

I am convinced that if Java can manufacture two million tons of sugar off an area of 425,000 acres it will not be impossible to raise 800,000 tons of sugar from an equal area devoted to cane in the eastern portion of the United Provinces and Bihar alone, leaving the remaining 2 millions and odd acres annually for *gur* making. It is a matter of profound regret that the Government of India have not been able to carry out any of the major recommendations of the Indian Sugar Committee appointed in 1919 and now that it does not appear within the range of practical politics that they will carry them out in the near future, I venture to suggest that the Government of India should, besides providing for permanence and continuity of the work being done by the Sugar Bureau at Pusa and by the Cane Breeding Station at Coimbatore, establish two Imperial stations, one in the western portion of the United Provinces bordering on the Punjab and another in the canal tracts of the Deccan. Temporary stations in addition may be opened in other important cane tracts in consultation with the Provincial Departments of Agriculture when it is considered advisable to do so in the interests of the industry.

I do not think any Province will ever staff itself sufficiently to have workers on every crop and on all points connected with it. Certain crops and problems must go to the wall for lack of workers and it is here the Imperial

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Government can step in to fill the gap. Deputy Directors in the Provinces have to work on a variety of crops and cannot therefore be expected to possess that detailed knowledge and experience which a crop like sugarcane requires and which can only be obtained by (1) visits to Provinces or central stations which are more advanced in their work on cane and (2) by keeping themselves uptodate with the literature emanating from the most progressive sugar-growing countries. Hence the necessity of entertaining a whole-time special cane staff to provide that expert knowledge to assist workers in the Provinces, many of whom may not have been outside their own Province or tract. It is not intended that there should be any control exercised by the Imperial staff over the staff in the Provinces. The object in view is to develop the sugarcane work in the Provinces in close co-operation with the local authorities and not to interfere in any way with their work nor to supersede any of the activities of the local department.

Problems such as the best type of bullock driven 2 roller and 3 roller mills, 5 roller power driven mills, methods of *gur* boiling, better types of furnaces are common to all Provinces. The same is the case with various questions relating to white sugar manufacture. The question of high class technical training in sugar manufacture can also be solved for all Provinces, if the Government of India accept the modest scheme outlined in the appendix.

(b) Lack of a Sugar Technologist and a Sugar Engineer has considerably handicapped our research work on manufacturing problems and on all problems connected with improved sugarcane mills and furnaces.

Lack of a suitable farm for proper cultural and manurial tests and for working out various problems connected with the growing of sugarcane, which would have been of great value to the established white sugar industry and to some Provinces.

QUESTION 3.—(a) From my close acquaintance with the conditions obtaining in this part of Northern India I can say that the presence of a small progressive agricultural class is a great asset as it forms a very useful medium for demonstrating and introducing agricultural improvements. This is well shown by the readiness with which progressive planters in North Bihar have taken up the superior varieties of Coimbatore canes recommended by the Sugar Bureau.

When zamindars take an interest and grow these superior canes on their own home-farms, the success of the crop is at once noticed by their tenants who are also cane growers on a small scale and the improvement, if within their means, is taken up by the cultivators with no further trouble to anyone. I therefore consider that in tracts where the zamindari system of land tenure prevails the first thing to do is to enlist the sympathy and the interest of the zamindar and to arrange for demonstration on his land of any agricultural improvements that are proposed to be introduced.

(b) Field demonstrations should be limited to doing certain work on a certain crop under guidance. It should as far as possible be started by one's own skilled men and then continued by the cultivators' or growers' men. What a man has done himself he believes in.

(c) Cultivators will be induced to adopt expert advice if (1) the improvement is really such that it does not require capital beyond their means to borrow and (2) the improvement will repay them not only for the high rate of interest that they have to pay to the *mahajan*, but for the extra trouble that they have to take and (3) the adoption of the improvement does not entail any far-reaching change in their agricultural routine and (4) the improvements are brought to their notice by the trained staff who can enter into their thoughts and feelings and can talk to them in a language which they can understand. As for example, it is no use recommending a heavy plough, no matter how good work it does, in a district where the local bullocks cannot draw it or where no facilities are available for repairs if the plough is broken or is otherwise out of order.

(d) The success which the Sugar Bureau has achieved in introducing superior varieties of Coimbatore canes within the last five years was brought

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about in the following way. First, four canes were selected out and large scale tests were carried out on land which was not considered good land by local cane growers, with implements and manures within the reach of ordinary growers. Growers were invited to see the crop whenever they liked and to watch the cultivation and manuring and finally the cane was put through the mill with a view to obtain complete data regarding the superiority of the new selected canes over the local variety not only from the growers' point of view but also from that of the factory. The cane was cut, handled, loaded and sent to mill exactly as an ordinary grower's crop would be dealt with. The growers were thus able to see that no operation was beyond their own powers and when they were satisfied on this point large scale distribution was undertaken. By constant touring I kept in close touch with the growers who were helped with advice. No attempts were made at first to convince the small ryot direct.

Things were first explained to the educated growers, the crop succeeded with them and from there worked its way into district practice, and then it filtered down automatically to the small ryots who are taking up these canes in ever increasing numbers. The reason for success was that we never asked anyone to take a risk. My experience is that no real improvement worth the name either in cane varieties or cultivation methods fails to catch on if it has been worked out on knowledge of the actual agricultural practice of the district.

Cultivators are sceptical of any success on a Government farm as they suspect that the large Government staff, costly implements and facilities for doing everything at the right time regardless of cost are the main factors contributing to the success and they know that they possess no such facilities.

We made no attempt to force miraculous yields for personal advertisement. Growers copied our methods and soon obtained confidence when they found in many cases they could do better than we had done. Failure to approximate to Government crop yields is in my opinion the chief cause of suspicion of Government farm methods.

QUESTION 4.—(a) So far as the sugarcane crop is concerned, I consider co-ordination of the activities now being conducted by the provincial departments and the central department extremely desirable and a committee of the kind proposed by me will be able to achieve this object (Appendix I). I am of the opinion that an organisation of the type of the present Board of Agriculture should be continued to enable scientific workers to meet together, to exchange ideas, to compare each other's experiences and to discuss programmes of work. This will break down the isolation of the workers in the Provinces and be to the good of all. This body should however have nothing to do with administrative questions or questions of policy.

(b) I consider that for crops like sugarcane, wheat, tobacco and rice which are common to more Provinces than one it is desirable that the central department should have a strong staff of specialists whose wider knowledge and experience can be drawn upon by the Provinces and when an urgent or serious problem arises in any Province in connection with these crops, their services should be made available to the Province in a spirit of co-operation. These specialists of the central department should have no authority whatsoever over the officers of the local department nor should they be allowed to criticise or pass any remarks on the work of an officer in a Province unless the local Director of Agriculture desires them to do so.

(c) Since the institution of the Reforms the Agricultural Departments are devoting increasing attention to the propaganda and demonstration side and are thus becoming more and more known to actual cultivators. But I would also like more work to be done on the research side as research is the foundation of all demonstration in that it provides material for demonstration. When the obvious improvements which have not required long detailed scientific investigation have been taken up by cultivators, the departments should have other improvements ready to hand for propagation among the agricul-

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turists. I also consider that a liaison officer should exist to work between the research side and the demonstration side in each crop.

(c) (ii) Speaking of the part in which my main activities lie I may say that on the metre gauge lines the train service so far as passenger traffic is concerned is so slow that I calculate some weeks of my active service have been wasted on their system in journeys. The railway company in the white sugar tract tries to meet the requirements of cane factories by running special cane trains, but the trucks are not of a good pattern or modern. Several branch lines can be opened in Gorakhpur district and in North Bihar which will pass through the cane area and while being successful from a revenue point of view will help the white sugar industry by providing cheap and quick transport of cane to sugar factories in this tract.

In Assam in the Brahmaputra Valley where good thick cane can be grown, it is the absence of railways and good *pucca* roads and bridges that is hampering the development of the tract. One factory that was put up there had to be closed down and another proposition had to be held over for want of proper communications in that part.

QUESTION 5.—(a) Sugarcane is a crop which requires considerable capital (the cost of cultivation ranging from Rs. 75 per acre in Bihar to Rs. 650 in the Deccan canal irrigated areas). Wherever possible, arrangements should be made through co-operative credit societies to finance sugarcane growers to enable them to obtain healthy seedcane of approved varieties and to purchase oil-cakes and artificial manures. To enable them to purchase good cane crushing mills, loans should be made by co-operative institutions providing such credit. Development of healthy, energetic, really useful co-operative societies in the white sugar tract in Northern India is a great desideratum and the sooner some vigorous action is taken in this line, the better for the sugarcane cultivators, the sugar industry and for the country as a whole, since with increased production of cane as the result of better manuring and improved cultivation and better appliances for crushing the cane the sum total of India's wealth will increase.

QUESTION 7.—(a) The development of the sugar industry in India has been considerably handicapped by the excessively small holdings of cultivators. It is not possible to obtain in one continuous block a sufficiently large area to meet the needs of a sugar factory.

QUESTION 8.—(a) I consider that in the white sugar tract in North India, there is room for providing irrigation supplies from rivers. I have found from experience that three irrigations given to the cane crop in the hot weather in this part make a considerable difference to the yield of the crop. In all cases before introducing irrigation schemes agricultural experts should be consulted and all such schemes should be properly designed. I am also of the opinion that the setting up of pumping installations in the white sugar tract on the banks of rivers and streams which do not dry up in the hot weather requires to be closely studied as, at present, much of the water in these rivers remains unutilised.

QUESTION 10.—(a) In my opinion India should make greater use of the various oil-cakes, fish manure and sulphate of ammonia produced within the country. For the sugarcane crop which requires from 75 to 150 lbs. of nitrogen per acre special manure depôts should be opened by the Co-operative Department in those tracts where *gur* making is the rule, and by sugar factories where they obtain their supplies from guaranteed growers of cane. Co-operative manure depôts should buy and hold manures as the rise in the price of oil-cake is very marked at the commencement of the planting season. As in Formosa, sugar factories should undertake to distribute artificial fertilisers to the cane suppliers and recover the actual cost *plus* a small rate of interest at the time the cultivator brings his cane to the factory.

(In Formosa companies now give manure free instead of paying bonuses to growers. This method might ultimately be introduced.)

I have always recommended the use of sulphate of ammonia, nitrate of soda, castor and other cakes among sugarcane growers in the white sugar tract

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and as a result of my efforts the British Sulphate of Ammonia Federation Ltd., have opened a depôt at Muzaffarpur and I am now endeavouring to get the Chilean Nitrate Committee to do likewise. I have also induced some of the factories to demonstrate the advantages of applying sulphate of ammonia and nitrate of soda on the cultivators' own lands and these, when found successful, are sure to be copied by other cultivators in the neighbourhood.

From experiments I have found that nitrate of soda is a good manure for forcing the cane crop for seed and sulphate of ammonia a good manure as a top dressing and the use of these fertilisers is increasing.

QUESTION 12.—(i) In this part of India where cane is grown without irrigation, deeper ploughing is to be recommended so that the cane setts may have sufficient moisture for germination and the cane crop may be better able to withstand high winds. The present implements do not ensure this deep ploughing and a satisfactory improvement on the *deshi* plough requires to be more generally adopted.

(ii) Cane should not be planted on the same land at short intervals as it is an exhausting crop. The suitable rotation for cane in this part is as under:—

- | | |
|--|-------------|
| (1) Cane—1st year. | |
| (2) Maize in the rains. | } 2nd year. |
| (3) Oats in rabi. | |
| (4) Green crop in the rains to be turned in. | } 3rd year. |
| (5) Fallow in rabi. | |
| (6) Cane again—4th year. | |

As the soil in this part of India is said to be deficient in phosphoric acid, an application of superphosphate at the time of turning in the green crop is very desirable.

QUESTION 13.—(i) Under the Government of India's Destructive Insects and Pests' Act, the importation of cane from countries having serious fungus diseases or insects pests is altogether prohibited or allowed under certain safeguards. Within the country there is no co-operation among cane growers as they are not aware of the causes which spread fungoid and insect pests. Selection of setts before planting so as to reject diseased material or canes which have been attacked by borers is not general and the Sugar Bureau is advocating sett selection. Red rot and mosaic are among the principal diseases and much useful work can be done by itinerant staff under the guidance of specialists in crop diseases.

White ants and borers do a considerable amount of damage. A special Entomologist to study these pests and to devise practical measures of control is an urgent necessity. More propagandist staff is also required to bring home to cultivators the enormous loss they suffer from the neglect of ordinary precautions in the case of those diseases and insect pests which have already been sufficiently studied.

QUESTION 14.—Foreign implements are costly and in villages where facilities for repairs are non-existent, they should not ordinarily be recommended. In my opinion, improvements in implements should be on the lines of making the desired alterations in the existing ones. The implements should not be heavy, otherwise the draught cattle will not be able to pull them. The price also should be well within the means of cultivators. Tractors are good enough for fairly large growers but as the majority are small cultivators, work should be concentrated on meeting their requirements. Horse hoes are very useful for intertillage and do the work cheaply as compared with manual labour and the Sugar Bureau is advocating their use.

QUESTION 16.—(e) Here I hold strong views. The backbone of India is agriculture. To make it popular among the zamindars and higher classes it must be made fashionable.

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The strength of English agriculture lies in the fact that every person of real importance in England from the King downwards is a farmer and is interested in farming and stock. The same cannot be said at present in India. The obvious method of making agriculture popular is to use the Honours List to this end. Every year honours are given for all manner of things to all kinds of people. Rarely if ever are they given to a man because he is doing his best to improve his land and the conditions of his tenantry or the agriculture of his estate. In short, rarely are they given for the one thing which is the foundation of India.

I think we should begin at the top. If the Viceroy had a farm for high class cattle and exhibited them, grew decent crops and helped to show that he was directly interested, it would give a direct fillip. Indian States would show remarkable improvement if guns and seed farms were correlated. Until it is definitely shown by some such means that the highest in the land are interested, I am convinced the landlords and upper classes will maintain their present attitude of practical indifference.

I am also of opinion that the failure in so many cases of zamindars and the landed classes to realise the obligations to their tenantry that their position entails is holding back agricultural development. A zamindar can assist his tenantry and improve conditions on his estates to a considerable degree if only it can be brought home to him that it is his duty as a landlord.

QUESTION 17.—(e) Sugar-making can be carried on only in large size factories. As these factories will have to be located in the cane district in order to be successful they will provide a subsidiary source of income to families having idle labour. There is room for a large number of factories in Northern India but they cannot be put up so long as sufficient inducement is not offered to capitalists by guaranteeing them against loss in the first ten years of the existence of the factory. Other countries are far ahead and we are wanting in skilled men and technical experience.

Gur-making which is a subsidiary industry so far as agriculturists are concerned is wasteful as conducted at present. The Indian ryot combines the functions of both producer of raw material and manufacturer of a finished product and on account of his inefficiency loses a great portion of his profits. *Gur*-making is therefore not to be recommended as a subsidiary means of employment. Only such occupations as are best done by hand labour and which do not require skilled supervision of an order not possessed by an agriculturist should be considered as worthy of recommendation.

QUESTION 20.—(a), (b), and (c) The sugarcane crop is worked up into two principal products, *gur* and sugar. *Gur* is of two qualities, (1) for direct human consumption and (2) the inferior grade fit only for refining. As regards good *gur*, the cultivator sells it to a middleman or sells it through a broker. The ignorant cultivator is very often cheated both in weightment and in price offered. Very often he has taken an advance of the money to enable him to grow the crop and he cannot hold his *gur* for a rise in the market nor risk keeping it through the rains. Co-operative *gur* sale societies can do a lot of good here. I will give an example. In the Nira Canal area of the Deccan, where high class eating *gur* is manufactured, the cultivators were not receiving the proper price when selling through brokers in Baramati. It was when a co-operative *gur* depôt was opened by the Bombay Central Co-operative Bank and when regular auctions were instituted which were widely advertised that the cultivators began to get the real value for their product and the depôt has been a great success. Work on similar lines might be instituted in important *gur* centres like Anakapalle, Meerut, etc. Where inferior *gur* is sold for refining, the competition of several refineries which are now working ensures a reasonable price in large centres like Siswa Bazar and Ghughli. But what I would like to see is some arrangement to enable the ryots to hold up their produce when the market is rising so as to sell it to the best advantage. At present they undoubtedly sacrifice most of their profit to the middleman.

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As regards white sugar manufactured by Indian factories, this sugar ranks with 24 D. S. and the chief markets are Cawnpore and Amritsar. All sugar is sold f. o. r. Cawnpore. This sugar is mostly consumed in Rajputana and Central India and the Punjab. In Java and Mauritius it is an association or syndicate of 90 per cent of the mills that effects the sale and not each factory individually. Here there is no such united organisation, and factories having limited godown space are obliged to dispose of their sugar as soon as they can for financial and other reasons. The Commission will get useful information on this point from the Indian Sugar Producers' Association, Cawnpore.

As regards *deshi* sugar manufactured from date palm in Bengal, the price of which is artificial as it is based not on sucrose value but on caste prejudice, the principal market is Calcutta where Hindu merchants, Marwaris and orthodox people, buy it. *Dobora* date sugar was selling at Rs. 25 and Rs. 22 per maund in the 1st week of February and March, 1925, when Java sugar was selling at Rs. 12-7 and Rs. 12-5 per maund.

As regards sugar made by *khandsaries* in the United Provinces, the price as in the above case is purely based on religious sentiment and it sells in local markets at a price much above its intrinsic value. The price of *deshi* sugar in Cawnpore in the last week of March, 1925, was Rs. 25 to Rs. 26 per maund when Java sugar was selling in the same market for Rs. 13-8 per maund. In the last week of March, 1926, while Java white sugar was selling in Cawnpore at Rs. 12-6, *deshi* sugar was selling at Rs. 18 to Rs. 23 per maund.

(d) As the importers of foreign sugar into India and manufacturers of white sugar in India were found to be not adequately informed regarding the state of the sugar crop in the world, the total supplies available, world's consumption and factors affecting production and consumption in any single year, I instituted a system of getting by cable reports regarding the condition of the world's crops and price quotations from important sugar markets such as New York, London, and Soerabaya and supplementing these by weekly market reviews and statistics likely to be useful to those dealing in sugar. Members from Bombay, Calcutta, Karachi, Cawnpore, Madras readily joined and they have found the service of great benefit to them. The whole cost is borne by the members who participate in the scheme. Consumers are also benefited as undue fluctuations in prices based on wild rumours are effectively squashed by this means. The popularity of this service has led two private agencies to greatly improve the nature of their news supply and as private enterprise is always able to do things better and more cheaply than a State department bound down by rules and regulations, the present service having done the work of a pioneer in this line, it may ultimately be unnecessary for the Sugar Bureau to continue it.

I think similar cable services can usefully be started for crops like wheat and oil-seeds. In fact I was asked by several merchants in Karachi during my last visit to start such a service and I had to inform them that my time was fully occupied with sugar. I referred them to the Government of India in the Commerce Department.

QUESTION 21.—The existing customs duty on imported sugar is Rs. 4-8 per cwt. of sugar 23 D. S. and above and Rs. 4 per cwt. of sugar 22 D. S. and below. The duty is avowedly for revenue purposes, the Government not having committed themselves to any statement that they were going to protect sugar in this way. Sugar manufactured by modern factories and refineries in India is not exported in any appreciable quantity as the production is hardly 100,000 tons which is not sufficient for India's requirements. The existing import duties do not adversely affect the interests of the cultivators as without such duties the *gur* industry would be severely threatened by cheap Java sugar. As sugar was selling at Rs. 38 per maund in August, 1920, the consumers have no reasonable complaint to make regarding the burden of this duty as the price has fallen to Rs. 13 per maund and the consumers of foreign refined sugar are those upper and middle classes who can afford it. Further, the imports of sugar are steadily rising which proves ready consumption.

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QUESTION. 23.—I believe that the spread of primary education in rural areas, however defective it may be, will be to the good of the community, as a knowledge of arithmetic however slight and the capacity to read and write will prevent the ryots of the future being cheated and defrauded in weights, measures, prices, payments for interest, etc. That in itself will lead to an amelioration of their condition to some extent.

APPENDIX I.

I propose that in view of the importance of the sugarcane crop in the rural economy of India and the heavy imports of over 700,000 tons of foreign sugar valued at roughly 15 crores of rupees, which imports can be met from the increased production in the country if well directed and sustained efforts are made to improve the industry, the work on the sugarcane crop and sugar manufacture should be placed on a proper and permanent footing. As the Government of India have hitherto been unable to carry out the major recommendations of the Indian Sugar Committee and it does not seem likely that they will be able to find funds for those recommendations in the near future I am submitting these comparatively modest proposals to ensure that (1) the interests of small cane cultivators as regards improved varieties, proper manuring, right type of cane mills suitable for their requirements, improved furnaces and pans may be met, (2) the interests of the white sugar manufacturing industry may be looked after and (3) the required provision for a high grade technical education in sugar manufacture may be made in this country.

Besides maintaining and making permanent the work being done by the Sugar Bureau at Pusa and the Cane Breeding Station at Coimbatore, it is necessary to provide immediately one Imperial farm on the western border of the United Provinces and the eastern portion of the Punjab somewhere near Karnal or Meerut, and one in the canal-irrigated tracts of the Deccan. These farms should each be of roughly 200 acres. Here improved varieties from Coimbatore and abroad will be tested, the proper system of planting cane, manurial treatment, water requirements, etc., will be studied. The cost of acquisition of land may be placed at 1 lakh in each case; buildings including residences for staff Rs. 1,50,000 and equipment Rs. 50,000 for the two farms. Thus the non-recurring charge on account of these two farms will be Rs. 4 lakhs.

The recurring charge may be placed at Rs. 12,500 for each farm exclusive of the cost in respect of pay of the subordinate staff which will be another Rs. 7,500 per annum or Rs. 40,000 in all for the two farms. Both these farms will be supervised by the Secretary, Sugar Bureau. These farms will provide facilities to the Government Sugarcane Expert to make observations on the behaviour of his canes, etc., which he at present lacks. There should be a Technologist attached to the Bureau whose salary will cost, say, Rs. 30,000 a year (Rs. 15,000 will be required for fittings for his laboratory, a non-recurring grant), the cost of a Head Chemist under him and the establishment may be put down at Rs. 10,000 a year while Rs. 5,000 a year will do for contingencies. A Sugar Engineer is also urgently required, the annual cost of whose salary will be Rs. 15,000, Rs. 10,000 may be provided for his staff and establishment (and Rs. 20,000 for plant, etc., a non-recurring grant) and Rs. 5,000 for miscellaneous expenses.

A Sugar Boiler or Factory Operator should also be recruited to work the small sugar factory mentioned below. His annual salary will be Rs. 12,000; his subordinate and technical staff, etc., will cost annually Rs. 10,000. For contingencies we may provide Rs. 5,000. There should be a small model factory attached to one of these farms and it may be estimated to cost £10,000 (it can be entirely manufactured in India). The annual recurring charge in connection with this factory may be estimated at Rs. 15,000. Cane for the factory will be provided by the farm. The Technologist, the Engineer and the Factory Operator will conduct their experiments in this factory. When these experts are recruited, high class technical education in sugar manufacture can be started which will supply a long felt want in India.

Apart from problems worked out in the factory these experts will study the various problems connected with *gur* manufacture, cane-crushing in small bullock driven mills, small power-driven mills, improved furnaces and the right type of pans.

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All this work should be under the control of an All-India Committee constituted as under:

The Agricultural Adviser to the Government of India.

The Government Sugarcane Expert.

Director of Agriculture of each Province or an officer deputed by each Province in his stead.

The Secretary, Sugar Bureau (*ex-officio* Secretary).

Representative of the manufacturing industry.

Non-official interested in sugarcane growing.

Member of the trade.

This Committee will meet at least twice a year to examine the work done and in progress and lay down lines of work. The cost of the travelling allowance and incidental expenses may be put down at Rs. 15,000 a year. This body will control expenditure and be directly under the Government of India. Its function as regards the Provinces will be on the same lines as those of the Indian Cotton Committee.

The cost of my proposals is as follows:—

<i>Recurring.</i>		Rs.
Sugar Bureau	.	45,000
Coimbatore Breeding Station	.	70,000
2 Farms	.	40,000
1 Model factory working expenses	.	15,000
1 Technologist	.	30,000
Staff	.	10,000
Contingencies	.	5,000
Sugar Engineer	.	15,000
Staff	.	10,000
Miscellaneous	.	5,000
Sugar Boiler	.	12,000
Staff	.	10,000
Contingencies	.	5,000
Meetings of the Sugar Committee	.	15,000
		<hr/> 2,87,000

<i>Non-recurring.</i>		Rs.
Model factory	.	1,50,000
Plant for Sugar Engineer	.	20,000
Cost of land for two farms	.	2,00,000
Buildings on farms and residences	.	1,50,000
Equipment for farms	.	50,000
Laboratory for the Technologist	.	15,000
		<hr/> 5,85,000

A capital cost of less than Rs. 6 lakhs is not at all a formidable figure for the Government of India; while against the recurring cost of less than Rs. 3 lakhs, a net revenue of not less than Rs. 50,000 may be anticipated, as fees will be charged to students undergoing training and for visits paid by experts to private factories at the request of the management concerned. As the Government of India already spend over a lakh of rupees annually on the Coimbatore Cane Breeding Station and the Sugar Bureau at Pusa, the net extra recurring cost involved is only Rs. 1½ lakhs a year which can well be incurred by the Government as cane is a crop which is in most Provinces difficult to replace if it proves unremunerative.

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APPENDIX II.

Area (in acres) under Sugarcane cultivation in India during the last five years.

No.	Province.	1921-22.	1922-23.	1923-24.	1924-25.	1925-26.	REMARKS.
1	United Provinces including Indian States.	1,162,000	1,359,000	1,554,000	1,303,000	1,448,000	
2	Punjab	373,000	497,000	483,000	396,000	359,000	
3	Bihar and Orissa	306,000	306,000	307,000	289,000	294,000	
	Chota Nagpur and Orissa Feudatory States.	15,000	15,000	20,000	120,000	14,000	
4	Bengal	221,000	201,000	202,000	206,000	215,000	
5	Madras	119,000	131,000	121,000	110,000	114,000	
6	Bombay and Sind including Indian States.	81,000	96,000	101,000	84,000	75,000	
7	Assam	41,000	42,000	42,000	42,000	41,000	

8	North-West Frontier Province	34,000	39,000	43,000	41,000	48,000
9	Central Provinces and Berar	17,000	19,000	22,000	22,000	23,000
10	Delhi	7,000	9,000	8,000	5,000	8,000
11	Mysore	32,000	38,000	54,000	32,000	32,000
12	Baroda	2,000	3,000	3,000	2,000	1,000
13	Burma, Ajmer, Marwar and Coorg	20,000	25,000	165,000	165,000	*158,000
14	Hyderabad State	31,623	33,370			
15	Gwalior State	10,330	8,846			
16	Kashmir	6,166	6,560			
17	Madras	19,350	6,990			
18	Central India	6,634	6,387	56,794		
19	Rajputana	6,350	5,376			
20	Punjab	41,254	56,794			
GRAND TOTAL		2,551,707	2,904,323	3,105,000	2,717,000	*2,820,000

*Provisional.

APPENDIX III.

Quantity and Value of Sugar 16 D. S. and above and 15 D. S. and below imported into British India during the pre-war year 1913-14 and last 5 years 1921-22 to 1925-26.

Year.	Gross Import.		Re-export.		Net Imports.	
	Tons.	Rs.	Tons.	Rs.	Tons.	Rs.
1913-14	803,000	14,28,85,185	9,700	20,74,048	793,300	14,08,11,137
1921-22	717,642	26,77,88,258	32,621	1,70,44,226	685,021	25,07,44,032
1922-23	442,976	14,84,76,065	62,962	2,92,35,348	379,414	12,22,41,607
1923-24	411,500	14,78,06,559	35,800	1,60,67,201	375,700	13,17,39,338
1924-25	670,965	20,36,89,515	21,990	91,49,460	648,975	19,45,40,065
1925-26	738,224	15,20,30,278	16,393	50,12,362	721,831	14,70,17,916

Oral Evidence.

A.1605. *The Chairman* : Mr. Sayer, you are Secretary of the Sugar Bureau?—Yes.

A.1606. You have provided the Commission with a note of the evidence that you wish to give. Do you wish to make any statement of a general character at this stage?—No.

A.1607. Would you give the Commission a short account of your own training and past appointments?—I came out here as Assistant to the Agricultural Adviser in 1914. I held that post until 1919 when I was appointed Secretary, Sugar Bureau. After that I was on the Sugar Committee as a Member during 1919-20 and then I reverted as Secretary, Sugar Bureau, which post I am at present holding.

A.1608. What is your view about the suitability of the site at Pusa for this station?—Admirable.

A.1609. Do you think that the comparative inaccessibility of the district is really any bar?—The industry is here and there is no bar at all, and therefore the inaccessibility does not have to be got over.

A.1610. That is so far as sugar is concerned?—Yes.

A.1611. Are you satisfied with the internal organisation at Pusa?—As regards the sugar work?

A.1612. In regard to sugar work, and also we should like to hear any views you may have on the organisation of other branches?—No, I am not. We have been left on a temporary basis for now 8 years. I think that it is high time that something should be done. It is neither fair to the work nor to the men working on it to be left on a temporary basis for this length of time.

A.1613. When you say 'we,' do you mean the Sugar Bureau?—Yes. I also refer to the Coimbatore Station which has only just been made permanent.

A.1614. Are you satisfied with the arrangements according to which the breeding of sugarcane is carried on at Coimbatore while the head and centre of the organisation is here?—Yes. The breeding must go on at Coimbatore; you cannot take it anywhere else, and the head and centre of the organisation must be where the industry is because in my opinion the ultimate end of *gur* will be white sugar and this will be the centre of it all.

A.1615. How about your touch with the Provinces? Are you satisfied with that?—Quite; there are no difficulties at all.

A.1616. Has anything been done for the sugar industry in Madras?—We have just appointed a thick cane expert. I do not know whether he will be able to do very much for Madras where exotic canes can be imported from other places like Hawaii. My own impression is that the man should have been recruited from a place like Hawaii where they have had experience of the thick cane industry and he then would have brought valuable knowledge and experience to bear on the subject; whereas we have taken a comparatively raw man with no knowledge outside India and we have considerably crippled the industry.

A.1617. Have you yourself ever been to Java?—Yes, I went as a member of the Sugar Committee.

A.1618. Do you think that was of advantage to you in your present position?—Distinctly. I also think the Government Sugarcane Expert should be sent and further that every man who has much to do with sugar should get a chance of seeing a highly developed industry like that.

A.1619. Had you difficulty in getting permission and the necessary financial provision for these journeys?—The Government of India at first disapproved of my suggestion that the Committee should go to Java, but it was urged on them and they gave way and we were allowed to go.

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A.1620. Are you satisfied, on the whole, with the achievements of your section in popularising improved varieties of cane?—I think considering the small staff we have and the fact that being on a temporary basis we have no possible means of retaining that staff we have done the utmost that is possible.

A.1621. Have you had any set-backs? By set-backs I mean other districts having once adopted your improved varieties and then discarding them?—None.

A.1622. Are the outlooks respectively of the grower and the factory in line at this moment?—No, I do not think they ever will be.

A.1623. Will you describe the difficulty?—The difficulty is due to the fact that so long as the factory and the grower are both independent units the grower naturally leans towards the heaviest quality of cane that he can grow because he is paid on the maundage basis. In a country like India where the ordinary grower is an uneducated man you cannot possibly pay him on a sucrose basis as is done in other countries.

A.1624. Why is it not possible to pay the grower on a sucrose basis?—Because, he is not able to understand even now the weights and measures at the railway stations. If he only understood the difference and were paid on the sucrose basis he would be all right, otherwise there is the danger of cheating. But the grower can be given a premium as is done by one group of factories for better quality canes having more sucrose.

A.1625. It is a good point for primary education?—Yes. The mill wants the highest possible amount of sugar from the cane. But the grower is naturally on the look out for an increased tonnage and therefore I have to constantly keep my eyes open to see that no bad cane creeps into the independent cultivation here; that would be a disaster from the mill point of view if it were generally grown.

A.1626. The difference in yield per acre in India on the average as compared with the yield per acre in some other countries is very striking, is it not?—Yes.

A.1627. Is it due to any inherent defects in the soil or climate of India?—It is due to the fact that the cane industry of India is concentrated in a sub-tropical part and is not a specialised industry. In those countries where you get enormous yields cane is grown in a tropical climate and is a specialised cultivated crop grown on modern methods, by proper manuring and proper scientific treatment.

A.1628. In your view there is no reason why the yield in India should not be as high as it is in other countries?—I think we have proved in this district that the present yields can be considerably improved.

A.1629. Does that answer apply both to wet and dry cultivation?—So far our chief work has been done on unirrigated land. My experience however is that once you have had the experience of unirrigated land, and then you apply it to irrigated land you could get a tremendous increase in yield.

A.1630. You said that in your view the present market for *gur* in India will ultimately develop into a white sugar market?—Yes.

A.1631. Is the *gur* market at the moment a stable and fixed market or is it liable to give way to sugar when the price of *gur* is higher in proportion to sugar?—As far as I am able to see, there is no connection whatever between them. I have a series of charts with me in my office which, if I had only had the time this morning to show you, would have convinced you of my opinion. From those charts you will see that when the price of sugar goes up that of *gur* does not necessarily rise in the same proportion but in some cases shows a fall.

A.1632. Does the consumption not tend to rise in *gur* and to fall at the same time in the case of sugar?—No, the consumption is not necessarily checked in that manner. When *gur* is cheap and plentiful, it has some effect on consumption of sugar but it is not appreciable. The *gur* market is purely a local market. The difference in prices in various places is such that I

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myself think that with proper organisation *gur* could be produced and sold at a profit.

A.1633. From your own experience do you think the *gur* market will develop into a sugar market?—Communications are improving everywhere in India, and nearly everybody has started to drink tea. The result is that cheap sugar can be got everywhere now. The consumption of white sugar is steadily increasing and it does not appear to me that *gur*, which is already based on a price which is far above the sucrose ratio, can carry on. It will ultimately be replaced by white sugar. I have now enquired whether it would be possible to take white sugar and molasses and make *gur*, and whether the component parts of *gur* could be bought from the outside market, and we are awaiting the result of the experiment.

A.1634. Now, coming to your note. Would you like to see the full recommendations of the Sugar Committee put into force?—I should like the chief recommendations put into force. But it should be remembered that they were based on rather too high a financial cost; they were too expensive.

A.1635. You think that good results can be obtained with less money?—Yes. I have put up a note embodying my suggestions.

A.1636. I only wanted to give you the opportunity of traversing any of the recommendations of the Sugar Committee if you wished to do so?—I have dealt with the matter in my note.

A.1637. On page 172 you are talking about certain failures to persuade the cultivators to adopt the improved varieties of cane. What failures have you in your view which go to show that Government crop yields have been so far above anything that the ryot could achieve, that disappointment has resulted and confidence has been lost? Do you suggest that in demonstrating improved cane the demonstration should be carried out on the scale and with the means available for the ryot; is that the idea?—I consider that the demonstration should be carried out first of all on the fields of a man who is a fairly big grower. To begin with, we should not go near the actual ryot. The demonstration should be done on the field of a man who is a fairly good cultivator and it should be done with the implements that he can use. We used to plant half the cane and then make his men and his bullocks do the rest. Then he was convinced that it was perfectly possible for him to do it.

A.1638. I misunderstood your note. I see what you mean is that the cultivator has adopted the crop and through faulty cultivation has not attained good results?—If you go straight to the cultivator, my impression is that he becomes suspicious. He will copy from his next door neighbour far more readily than he will copy from you directly.

A.1639. On page 173 you suggest that in India, as in Formosa, "sugar factories should undertake to distribute artificial fertilisers to the cane suppliers and recover the actual cost *plus* a small rate of interest at the time the cultivator brings his cane to the factory." Are you thinking there of a group of growers organised co-operatively with the factories as their centre?—I am thinking of small ryots, who supply their cane to the factory, who take an advance from the factory and then bring their cane in. Those men will always take artificial fertilisers in small quantity and it can be knocked off what is known as their cane account.

A.1640. Are the firms which are selling fertilisers on a commercial scale in touch with the factories?—I have put them in touch with every factory now.

A.1641. Have they responded?—Yes.

A.1642. Have they got any agency which is ready to do anything for them?—Yes; they have opened a depôt already in Muzaffarpur.

A.1643. You say, "In Formosa companies now give manure free instead of paying bonuses to growers."?—They might give a certain amount of money as bonus, or instead of giving the man half an anna or more they might give him so much manure.

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A.1644. Is that a bonus on the sucrose-content?—Yes, but we could not do it out here just now, although this method might ultimately be introduced. We have got to get more educated growers before we can take that step.

A.1645. Your note will be printed and I should like to ask you to turn to the first page of the note which is attached as an Appendix to your note of evidence. You say: "Besides maintaining and making permanent the work being done by the Sugar Bureau at Pusa and the Cane Breeding Station at Coimbatore, it is necessary to provide immediately one Imperial farm on the western border of the United Provinces and the eastern portion of the Punjab." Do you refer there to one institution?—Yes; it should be on the western border of the United Provinces and the eastern portion of the Punjab; it will carry both the Provinces.

A.1646. Have you ever considered the possibility of organising the sugar industry for the purposes of research in the same way as cotton is organised?—We had a proposal that they should subscribe to a cess and start some scheme of that description. I think 95 per cent of them have agreed to this scheme but there are a certain number of factories which have not agreed. They thought that Government ought to pay the whole cost of research and that it was not fair to make the factories subscribe.

A.1647. Would you yourself favour such a scheme if it could be financed?—I think it is admirably sound.

A.1648. In that scheme would you attempt to include representatives of the trade: that is to say, representatives of the sugar manufacturing industry and their distributors if they could be represented by a suitable person; in fact, all persons connected with the sugar industry in this country?—I am sorry I do not quite understand your point. Do you mean with regard to the question of this cess?

A.1649. I was thinking of the organisation which the cess will finance?—Certainly.

A.1650. I understand that you have a series of graphs dealing with various aspects of this problem. Would you let us have copies of those?—Certainly.

A.1651. Perhaps you could send them to the Secretary?—I shall.

A.1652. Do you wish to say anything about the import duties?—There is, of course, at present an import duty on sugar. I think myself that, if it was in any way possible, some portion of that import duty might be given for research, though I know when we mentioned the matter on the Sugar Committee, it was not accepted. I do believe that a small portion of it might be given to finance sugar research. The import duty comes to 5 crores and I think myself that sugar would stand an extra 4 annas per hundredweight on the duty.

A.1653. *Sir Henry Lawrence*: In your later note* you have mentioned that the primary work, you consider, is to select out a suitable cane or canes for white sugar making. You have now told us that you are working as much as possible in order to improve the interests of the cane grower?—Yes.

A.1654. From this solitary sentence it would appear that you are thinking more of the interests of the factories. Would you like to tell us anything in this connection?—It is absolutely impossible, as conditions stand at present, to think solely of the interests of the factory. The grower must come first. You cannot grow any particular variety of cane in India for any factory unless the grower approves of it. There is no legislation to make the grower take it up; he can refuse to take it up. Therefore, the cane must always favour the grower to begin with or the factory will get no cane.

A.1655. Can you tell us what proportion of the cane grown in India is at present utilised by factories and what proportion finds its way into the market direct from the grower?—The factories in India make between 70 and 80 thousand tons of white sugar direct from cane, including *gur* refined in modern refineries.

* Not printed: Note on the work done in the Sugar Bureau, Pusa, prepared by Mr. Sayer for the Commission.

A.1656. *Sir Ganga Ram* : How much do they make by the direct method and how much by converting?—The direct manufacture of sugar from cane is about 40,000 tons, perhaps a little more. The remainder 30,000 tons is made from *gur*. The rest of the cane in India less what is chewed, is made into *gur*.

A.1657. *Sir Henry Lawrence* : What unit of figure would that represent?—The remainder would represent nearly 3 million tons.

A.1658. So that factories only deal with about 3 per cent of the total cane cultivation in India?—2 per cent.

A.1659. Your work here is not limited to the interests of 2 per cent but is equally in the interests of the other 98 per cent?—Absolutely. Our cane has been distributed in Burma. I think it is distributed in every Province except the Madras Presidency.

A.1660. Can you surmise at all what area of land is now being cultivated with Co.213?—Round about here the area is about 12,000 acres. I have at present no figures for the other Provinces.

A.1661. You cannot form any estimate at all?—Not really. I can get the figures for you.

A.1662. I think it would be useful to get the particulars; could you communicate them later on?—Yes, I will.

A.1663. You have told us that you had visited Java; can you give us any information as to the conditions under which cane is grown in Java for the use of factories there?—Factories as a rule have not got their own estate under their own ownership; they lease the land from a village. The land is taken usually through the headman and comprises $\frac{1}{3}$ rd of the total land of that village. The factory takes it over from the village, opens it out for planting the cane in trenches, plants the cane, grows the crop, and finally returns the land at the end to the village at the end of the crop.

A.1664. Have the individual holders of the land in these villages got the option to give their land for this purpose, or are they bound by any law to do so?—The arrangement is made through the headman of the village, who seems to be able to persuade all the other people in the village to enter into this agreement.

A.1665. You think it is done by persuasion and not by legal force?—I do not think there is any legal force; it is really by persuasion, though weight may be given to it by the tradition of the old forced culture system now abandoned. It benefits the village and financially it benefits the headman.

A.1666. Have you heard about the conditions in Java published in a book by Mr. Keatinge?—I read the book a long time ago. I think it was a report of a tour he made.

A.1667. Perhaps you would look at it and see whether the information given there is correct?—I have got the Report of the Sugar Committee which is more recent than that.

A.1668. You think it is not true that the cultivators are in any way bound to supply their cane to the factory?—No; it is not the cultivators' cane; it is the factory's cane.

A.1669. They are not bound to supply their land?—I do not think that they are legally bound to do so at all. As far as I remember, the arrangement is made through the headman; they have got the right of appeal. A Government officer sees to it that the rent paid is fair. I think the headman manages to control the whole village.

A.1670. Did you investigate this point when you were there?—We carried on a considerable amount of enquiry about it, but there seemed to be silence when it came to some of these facts.

A.1671. That would be very natural?—Yes.

A.1672. Then you state that it is impossible to get a ryot to accept payment on a sucrose basis; are you acquainted with any factory where it has been attempted?—I am acquainted with the factory at Samastipur. They

attempted to put matters on a sucrose basis with the European planters, but there were continual quarrels about it. The ryot, whose cane is generally bought at the railway station and paid for there, would never accept such a basis; he would invariably think that he was being deceived or cheated.

A.1673. I understood that this basis had been introduced in the factory at Baramati?—They have a fairly educated ryot there, and they took the cane there on the *gur* value. Paying on the sucrose basis would mean analysing every cart-load of cane and of paying so much for sucrose over a certain percentage. They simply took a sample and calculated the *gur* value for the amount of cane and paid on that basis. On that basis it became impossible to manufacture sugar. The factory is now shut down.

The Commission then adjourned till 10-30 a.m. on Tuesday, 11th January, 1927.

APPENDIX.

Copy of letter No. 2441, dated Pusa, the 8th March 1927, from Wynne Sayer, Esq., B.A., Secretary, Sugar Bureau, Pusa, to the Joint Secretaries, Royal Commission on Agriculture.

I have the honour to state that I want the cess to cover the sugar work of the Sugar Bureau and its proposed extensions as detailed in my note;* it will finance the work of the Cane Breeding Station and any extensions. It will meet the cost of the Sugar Board and expenses connected therewith. It will finance all work on the entomological, mycological, chemical and other scientific sides to be done on sugar by the Central Government. It will finance all farms established by the Sugar Board in the Provinces and will also be available for grants-in-aid of cane work, to the local research and propaganda being done in all cane growing Provinces and enable any further work requiring funds to be taken in hand as occasion arises.

* Appendix I to "Replies to the Questionnaire," pages 178 and 179.

Tuesday, January 11th, 1927.

PUSA.

PRESENT :

The MARQUESS OF LINLITHGOW, D.L. (*Chairman*):

Sir HENRY STAVELEY LAWRENCE,
K.C.S.I.

Sir THOMAS MIDDLETON, K.B.E.,
C.B.

Rai Bahadur Sir GANGA RAM, Kt.,
C.I.E., M.V.O.

Sir JAMES MACKENNA, Kt., C.I.E.,
I.C.S.

Mr. H. CALVERT, C.I.E., I.C.S.

Professor N. GANGULEE.

Dr. L. K. HYDER.

Mr. B. S. KAMAT.

Mr. J. A. MADAN, I.C.S. } (*Joint Secretaries.*)
Mr. F. W. H. SMITH. }

Mr. WYNNE SAYER.

Further Oral Evidence.

A.1674. *Sir Henry Lawrence*: Could you tell me anything about the touch that there is between the experiments in Coimbatore and the work in Upper India? Do the Coimbatore officers have any facilities for spreading their results in Upper India on a satisfactory scale?—There is no organisation by which the Coimbatore officers can spread their results in Upper India except the touring done by those officers and the touring which I do. The need for liaison between the work in Coimbatore and the work in the Provinces is, I consider, one of the greatest needs at present. I find it is very rarely that any Deputy Director doing work on cane in the Provinces of Northern India has been to Coimbatore and in consequence it is necessary to advise and help a man of that description far more than it would be if he came down occasionally and saw what was going on. On one occasion I toured in a certain Province to examine a site for a sugar factory. I examined the site and I recommended that they should, on the amount of water they were allowed, grow a certain cane. I told the man that I would send him down this cane or he could obtain it from the neighbouring agricultural station. He replied that that was not the cane that the local agricultural station recommended. I then went to the local agricultural station. I discovered that owing to some reason they had got their canes mixed and were advocating the distribution of the cane I recommended under a different number. That sounds like a thing which could be easily remedied. But if you are recommending a cane under the wrong number, and the people get that cane under the number you recommend from another place, they get a totally different cane and they do not discover their mistake until possibly they put a large area down and incur a big loss. I suspected that this cane was wrongly numbered owing to a mistake and we took the necessary steps to get it put right. But I am positive that mistakes like that are probably occurring every day all over the place and I consider that all the officers who have anything to do with cane and cane work should have an opportunity of coming into much closer touch with Coimbatore.

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A.1675. It appears that two things are necessary, first, that the officers of the Provinces dealing in cane should be not merely invited but ordered to go to Coimbatore?—Certainly; I would make it part of their job. If they are going to deal specially with cane they should certainly go to the headquarters of cane breeding. In short, they should go anywhere in India where they would be likely to get assistance and further experience of the work they are undertaking.

A.1676. Do you suggest that Mr. Venkatraman, the Research Officer at Coimbatore, actually has to travel through India like a commercial traveller with samples of cane in his pocket and put them down in different fields?—His tours in Northern India have been to a large extent to show how to grow his cane instead of his doing scientific work. I believe in one year he travelled at his own expense, because his travelling allowance grant was exhausted and he felt that he must go round to some of these places. I could not go and he wanted to see what was going on because he has felt for years, as I have, that the reputation of Coimbatore canes was in such slender hands in the north of India that the canes were very likely to be absolutely damned, not through any fault on the part of the cane but through the fault of the people who were trying to grow the cane in the wrong fashion.

A.1677. You mentioned about cane Co.205. I do not quite understand your answer that the growth of the cane might be a disaster to factories?—Co.205 is a cane of a very strong type which will grow anywhere. It has however a very low sucrose content. Now where you have a body of growers growing cane on their own responsibility and supplying it to the factory they will naturally go all out for a cane which is easy to grow; but it is very low in sucrose content and the factory will therefore lose if such cane gets out into general cultivation.

A.1678. But it is a cane that is of value in certain low-lying tracts?—I am giving it out to those districts with low-lying tracts and for all lands which will not take Co.214, or Co.210 or Co.213.

A.1679. In certain conditions it is of value?—In certain conditions it is of extreme value.

A.1680. Now I notice in the Sugar Committee's Report there was a note of dissent by you. Could you tell us anything further of the subsequent results on those points in which you dissented some seven years ago?—I wrote that note of dissent because I considered that we should have made a definite recommendation in the Report for the licensing of areas. I saw trouble coming in Saran, a cane district over the river here where you have factories having no land of their own. It is always the case in the cane area that a new factory may come along and build near a railway station and proceed to buy cane from the district. Now I dare say you know the limit from which cane can be carted to a factory is ten miles and the limit of the rail haulage is some 80 miles in this district. If a factory is established in a place like Samastipur in a district with no competitors round and is willing to pay a fair rate for cane, it is interested to see that the cane grown all round in the district which comes to it is of the best quality; the growers are also benefited in every way and care is taken to see that their seed is pure and they get manures at a cheap rate. But suppose Samastipur suddenly discovers a new factory put up at the next station Pusa Road—which has a right to buy cane throughout the Samastipur district. Now at once Samastipur factory would say, "Why should I send my men round to distribute good seed and give facilities for manure if you have no guarantee that the cane they grow will come to us?" I foresaw that position was going to occur in Saran and the position is most acute there to-day. Two big factories lately erected are doing extremely bad work due, I think, to the fact that they cannot get cane and to the fact that nobody is now interested in the district. I cannot get my canes distributed except by myself nor can I get facilities for assisting the ryots through the factories because every factory answers, "I do not know to whom to supply this cane."

A.1681. *Sir Ganga Ram* : So you want legislation for it?—I would say, if a factory is doing perfectly good work, prevent another factory from coming in.

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A.1682. *Sir Henry Lawrence* : You seem to accept the suggestion that legislation would be required. It is not necessary, is it, supposing you license the factory in a certain area?—But how are you going to stop what is now going on, all the factories congregating round a certain area?

A.1683. What you aim at is a form of co-operation between a factory and the grower which would be of benefit to both the parties?—Yes.

A.1684. The grower is to be assisted in getting good seeds and manure by the factory?—Yes. There is no difficulty about that. The factories are doing it in those areas where we have got control. The only place where I cannot get anything done is in the district I referred to, where the factories are all competing against each other in the same area with no actual control over the cane they are trying to get.

A.1685. And you are quite sure that the interest of the country is concerned with the greater outturn that is secured by this system and that the cultivator will not be damaged by the absence of competition between factories? You know that is the greatest argument against your point?—I know; but I do not see why the cultivator should be damaged. Every factory will pay a fair price for its cane. The small man has always got the alternative of selling his stuff as *gur*. The cultivators know a good deal about prices now. Another point I would like to make is this. When you are attracting cane to a factory you must start at a price which you may not be able to maintain. The moment you go below the price you start with, the supply of cane stops.

A.1686. I take it that you adhere to your note of dissent and consider that you are justified in what you wrote there?—I consider that I have been fully justified. The evidence you will get from the Indian Sugar Producers' Association will back me up.

A.1687. *Sir James MacKenna* : You have got no support from the Sugar Committee?—I got no support whatever. The idea was that I was interfering with the liberty of the individual.

A.1688. *Sir Ganga Ram* : Are you quite sure that legislation like that will be passed by the Assembly?—I am not sure of the Assembly doing anything.

A.1689. Who will govern the price?—The price is governed by agreement between all the factories.

A.1690. Is there any agreement between factories?—There are two factories working up here under agreement.

A.1691. I suppose they pool between themselves?—If I may tell the Chairman I have a witness here who could give evidence on the subject. He is the Cane Manager of the Lohat factory and he will be able to tell you everything.

A.1692. I only wanted to tell you that there is something intermediate between refined sugar and *gur*, what we call brown sugar. Do you know anything about it?—No.

A.1693. You get it by a more careful treatment of *gur*; have you made any research on that?—No; I have no staff to do so.

Recently we saw it in Madras. We had brown sugar for coffee; all the Members know that. It is made in my village at the same place where *gur* is made and they make it very nicely; it is known as *shakkar*. I am sorry I did not bring a sample with me but I will get it to-day. The reason why they do not use the *gur* is they cannot put it in milk or anything like that.

A.1694. You might undertake research with regard to refined sugar of a good kind, at the same time showing the people how to make use of the superfluous material, because the yield must be less than the yield of *gur*?—Yes, but the price will be higher.

A.1695. I got Rs. 8 instead of Rs. 6 this year; I will send you a sample?—I should like to see it.

A.1696. I think a good solution of the problem in one way would be to reduce the consumption of white sugar and induce Indians to take more brown sugar, not in the form of *gur*?—Why do you wish to reduce the consumption of white sugar?

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A.1697. To meet the home demand by an indigenous product, thus reducing the import from Java. That is a good argument, is it not?—I do not think it is very sound.

A.1698. Why?—Because it is putting forward a process by which you cannot make sugar as cheaply as it can be made in a first class factory.

A.1699. If you conducted research with a view to improving it by some chemical process, I think that would be a good solution of the problem. I suppose you know that the Java sugar is refined by means of bone charcoal; is not that right?—Yesterday I heard you say that bones were sent to Java and that they came back in the sugar; that gave me rather a shock.

A.1700. But is not bone charcoal largely used in refining sugar?—Bone charcoal is used in refining raw sugar.

A.1701. *Sir Thomas Middleton*: Have you studied the cost of production of cane in different parts of India?—I have collected a lot of figures, but I cannot say that I have particularly studied the cost of production, because the only place where I have had the opportunity of doing any work on the subject has been here, dealing with this district.

A.1702. From the data you have collected can you say whether the cost of production per maund varies widely?—From the data in my possession I should say that the cost of production per maund of these new canes varies from 3 to 4 annas.

A.1703. Does that reply refer to Bihar and Orissa?—Yes.

A.1704. Does it include Bombay?—No, I am referring only to the white sugar tract on which we are working here; I do not include Bombay or Madras.

A.1705. Can you give us any idea of what the cost is in Bombay or Madras?—I can certainly give you the figures, but I have not personally made any experiments to check whether those figures are accurate or not.

A.1706. What are the figures which you accept?—I have a figure for Bombay of Rs. 650 per acre as the cost of growing cane.

A.1707. *Sir Ganga Ram*: Does that include the cost of fertilisers?—I sincerely hope it includes everything, because it is an extraordinarily high figure.

A.1708. *Sir Thomas Middleton*: For how many maunds is that?—That I cannot tell you; I should certainly hope that it went up to 40 tons. I have a figure which was given me when I was last in Bombay; the cane that came into the factory there cost $10\frac{1}{2}$ to 11 annas per maund.

A.1709. Then in Madras what figure have you yourself accepted?—I cannot give you the Madras figure; I can get it for you.

A.1710. No, not unless it is a figure which you yourself have used?—I have given it to people, but I have not verified it; I have done no experiments verifying it.

A.1711. You speak of the use of nitrate of soda in connection with the production of seed cane?—Yes.

A.1712. Cane setts I think?—No, seed cane; that is to say, cane which is going to be used for seed as apart from mill cane.

A.1713. That is what I intended to indicate, the growing of cane setts; cane seed is only produced at Coimbatore?—Yes.

A.1714. Why should nitrate of soda prove to be preferable to sulphate of ammonia?—I find that nitrate of soda, if applied in two or three doses during the rains, grows the cane on, and keeps it green and immature for a longer period than any other manure I have yet tried.

A.1715. It is the successive doses that do the good?—Yes, I think so, giving the last dose as late as possible before the cane stops growing.

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A.1716. I have not read your note of dissent on the Sugar Committee's Report and I do not yet quite follow your argument. If I were a grower of cane, I should prefer to deal with two factories rather than one?—And then when there was a full crop, what would you do?

A.1717. I should make my arrangement with the factory with which I usually dealt?—You would meet the *jamadars* on the weighbridge; *jamadar* No. 1 would say, "My factory can take no more cane to-day." You have brought your cane 10 miles, *jamadar* No. 2 would say; "My factory also is full." You would go back to *jamadar* No. 1, and he would say: "I will give you 2 annas a maund for that cane."

A.1718. I should not go 10 miles before I found that out. You indicated there was an alternative market, namely *gur*?—Yes.

A.1719. Before going 10 miles with the cane, you presumably would find out whether the factory would take it?—Not when you are an independent grower; you go straight to the station and meet the *jamadar*, and frequently have to face the cost of taking the cane back 10 miles or accepting a price which is much less than the actual figure.

A.1720. I see the force of your suggestion if your difficulty lay in getting capital for starting the industry?—Why getting capital? You can always get capital.

A.1721. Because if you did find difficulty in getting capital for starting a mill in a particular area, it would be a great incentive to those putting down money if you licensed a monopoly for an area?—The difficulty in getting new capital for a sugar concern in an area which would grow cane perfectly well is due to the fact that until the factory comes there the cane is not always there. The factory at Samastipur was started on guarantees from large growers. There was not sufficient cane for a factory before. In places like Saran the cane is there, but it is virtually the property of another factory; you always find capital for piracy, which is what it amounts to.

A.1722. The effect of your restriction would be to prevent piracy?—Where is the benefit of piracy?

A.1723. I understood you, by "piracy," to mean the coming in of a second factory?—Yes. Where is the benefit of that?

A.1724. There is benefit in licensing to persons who have established factories because it restricts competition?—There is no benefit to the grower ultimately in allowing factories to be established without a license, because if two factories are established in this way on one area it ends by both factories working half-time if there is not enough cane, and therefore their expenses go up much higher. Sooner or later one breaks and the other factory is left in charge of the area. What happens then? Generally it happens that the one that is left proceeds to recoup his losses.

A.1725. I quite agree that may happen?—What I am particularly anxious to see is each sugar factory mothering the area from which it draws its cane, regarding the interests of the ryots as its own interests, and helping them in every way, as is being done here.

A.1726. We should all agree if we could guarantee the character of the mother?—I think on Thursday I can produce a couple of gentlemen who will guarantee the character of the mother, as they have already run the arrangement quite well.

A.1727. *Dr. Hyder* : I have had the benefit of reading your note of dissent which you wrote on the recommendations of the Sugar Committee. You are in favour of licensing factories?—Yes.

A.1728. That means restriction of the number of factories in a particular area so as to ensure a constant regular supply of cane to the factories?—Yes.

A.1729. The recommendation of the majority of your colleagues is as follows: "A comparison of the cost of producing sugar in India with the cost in other countries shows that it is in respect of cost of manufacture rather than cost of cane that Indian factories have to fear foreign competition." If you restrict the number of factories and make over a certain area to a

particular factory, then you destroy all inducement to the factory to bring about any reduction in cost?—I do not agree. It does not necessarily follow that if the area for a particular factory is demarcated, that factory will not improve its efficiency. Take the examples of Samastipur and Barachakia both factories with no competitors, which are very efficient while Lohat, Japaha and Pusa are steadily improving their efficiency without the stimulus of internal competition from other factories. I consider sufficient stimulus and competition comes from outside India to insure efficiency.

A.1730. I agree with you it would be better to have a factory which gets a constant supply of cane. On the other hand this question of increased efficiency must be solved?—The question of the efficiency of the factory is rapidly being solved; the best of them have improved over 2 per cent since that report was written.

A.1731. *Sir Henry Lawrence* : What does that figure of 2 per cent mean?—Sugar in bag per 100 maunds of cane crushed.

A.1732. *Dr. Hyder* : At present the duty is specific and not on an *ad valorem* basis?—Yes.

A.1733. So that when the price of sugar falls that means there is a higher protection to the sugar manufacturer in India; is it not so?—The specific duty means a regular protection to the manufacturer in India.

A.1734. If my arithmetic, which I did rapidly, is correct, on your figures when sugar is selling at Rs. 38 per maund the rate works out at 8 per cent, while when the price of sugar falls to Rs. 13, the same duty has the effect of a duty of 21 per cent?—That is true.

A.1735. That is desirable from the point of view of the sugar manufacturer, is it not?—I do not look at it from the percentage point of view; I look at it in this way, that Rs. 4 or Rs. 4.8 is the protection, if you like to call it so, that the sugar manufacturer can expect whatever price sugar may drop to; should Java ever manage to land sugar in Calcutta at Rs. 5, the protection of Rs. 4.8 would be very nearly 100 per cent; the sugar would then be at Rs. 9.8, at which a lot of factories would fail to carry on, but some might just exist. On the other hand, if sugar rises to a higher figure, the protection does not increase as it used to with the *ad valorem* duty.

A.1736. They do not want protection then?—Exactly, that was felt with the *ad valorem* rate.

A.1737. You went to Java?—Yes.

A.1738. Can you tell me what use was made of the bonemeal? Was it used partly for manure and partly for refining purposes?—I will discuss the question of bone afterwards.

A.1739. *Sir James MacKenna* : You say that as a result of the non-acceptance of your recommendation to reserve land to factories numerous factories are springing up all over the place. By whom are these factories being put up?—The factories referred to are being put up by Indian firms.

A.1740. So that the acceptance of your recommendation would have been to limit the development of the sugar industry to the large European settlers?—No, it would have been to send these Indian factories to a district where they would certainly have had to take a little time and trouble to work up their supply of cane but they would then have been assured of a proper supply and they would have assisted in developing the industry.

A.1741. With reference to the Coimbatore station, when we were in Madras we heard that a thick-cane expert was being appointed. Is that appointment under the Government of India or under the Government of Madras?—It is under the Government of India.

A. 1742. What is the relation of your Bureau to the work of Mr. Clarke at Shahjahanpur?—It sends him any canes that we think might assist that portion of the United Provinces if he asks for them. It also would give him any assistance which he might require or any figures, and it would willingly help him with any cultivation problems that might arise.

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A.1743. It would. But does it?—It does not do anything for him at present.

A.1744. Is the Sugar Bureau under the Agricultural Adviser?—Yes.

A.1745. Your idea is, I take it, to develop the Sugar Bureau very much on the lines of the Cotton Committee's method of working?—I want to develop the Bureau so that it may become a Sugar Research Section.

A.1746. In fact it would become stabilised instead of floating about in places?—Yes.

A.1747. *Professor Gangulee*: You are in touch with all research work in connection with sugar?—Yes.

A.1748. Could you tell the Commission what are the chief research problems that need immediate attention?—On which side would you like me to make a recommendation?

A.1749. Let us take the agricultural side?—The chief problems which require attention on the agricultural side are improved varieties of cane. We want to try and produce a cane not only for every Province in India but further than that for different districts and tracts in every Province.

A.1750. Is it the case that Indian sugarcane on an average has low value so far as sucrose contents are concerned?—Indian sugarcane, as far as I have had experience, is chiefly remarkable for its very low tonnage per acre. I believe that an Indian sugarcane is not bad as regards sucrose content, but the low tonnage per acre makes the cane almost unprofitable.

A.1751. Then your opinion is that it is not due to the quality but to the quantity?—Yes.

A.1752. With regard to the technological side?—I have put up proposals for a technologist to be attached to the Sugar Bureau and also I want an Engineer.

A.1753. Then the whole problem of sugar manufacture requires to be tackled?—The whole problem is this, that at present in India we have no technological staff whatever. If anybody puts up a factory and gets into difficulties he comes to us for assistance. I am unable to assist him, greatly to my regret.

A.1754. Referring back to the agricultural aspect of the problem, is any definite research necessary for the improvement of the cultivation of sugarcane?—Certainly, I think a lot of research is necessary.

A.1755. In what direction?—I consider myself that the earlier ripening of canes is linked up here with the time of planting to give them a long growing period. Then there is the question of the depths to plant and further we have got the question which is always arising as to why certain lands will not hold certain varieties of cane. I have at the present moment found that in Saran Co.213 does not do anything like as well as it does on this side of the river, but Co.210 does quite well. That problem requires elucidation.

A.1756. At Coimbatore only the cane breeding work is conducted?—I would not go so far as to say 'only'. I think there are many other lines of work on which Mr. Venkatraman is working.

A.1757. Would it be convenient to have facilities provided there for work in connection with cane pests?—I would prefer that you should address that question to Mr. Fletcher.

A.1758. I want your opinion on the question of linking up the Mycological Section and the Entomological Section with the Cane-breeding Station?—I think that these two sections should be linked up more with where the cane is grown than with where the cane is bred. They should be working up here where the major part of the industry and the crop is to be found.

A.1759. Where would you carry out your experiments and investigations on the engineering and chemical side of the sugar industry?—Here, in this place, which is the centre of the industry.

A.1760. Is it your opinion that the areas under Coimbatore canes are gradually expanding?—Yes, very fast.

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A.1761. In Northern India?—In this tract round here.

A.1762. As well as in Northern India?—So far as Northern India is concerned I have no actual figures, but I could vouch for this part of India.

A.1763. *Dr. Hyder*: What is your impression? Are they extending in the United Provinces?—Yes.

A.1764. *Professor Gangulee*: Do you think the present Coimbatore canes have reached their final stage of development?—No.

A.1765. Do you think you will have to have new varieties in future?—I am of opinion that we have got to work steadily on improving not only the class of canes which we are turning out from Coimbatore, but also we have got to watch very carefully when anything turns up that may bring these canes back to a stage where they are unprofitable, such as disease, pests or some such thing.

A.1766. In order to extend the use of Coimbatore canes, do you think it necessary to have a certain number of sub-stations through the Provinces?—Yes.

A.1767. What would be the nature of the work of these sub-stations?—These sub-stations would duplicate the work that we are doing here with reference to the local problems of the Province, and would also get direct from here canes that we have made a success of. In short we should try to run a station which would enable the local officers of the Government in each Province to go a short distance and see exactly what was being done there and the extent to which our experience was of value.

A.1768. These sub-stations would be under Imperial control, under the direction of the Coimbatore station?—No; I would like to have these sub-stations under my own control as regards the growing of cane, and the Cane-breeding Expert of Coimbatore would have all the facilities there for doing any experiments he wanted to do. But as regards the growing of canes I would prefer to have the work under my own control. When you have a scientific officer like Mr. Venkatraman, I consider that his work is especially of value when it is being done at Coimbatore on the specific problems which he is required to deal with. He should not be concerned with the cultivating problems of Northern India.

A.1769. What would be the relations of the provincial departments to the sub-stations?—They would be invited to make use of the sub-stations for advice, etc. The sub-station if it was under me would not be allowed to criticise, or to pass any orders on what the Local Government was doing. It would merely stand there and say, "If you want my advice on any particular point I am ready to give it." It should not criticise.

A.1770. Even if the criticism is helpful?—No, it could always give it unofficially and that would be always accepted.

A.1771. Have you any experience with regard to the method of "short planting"?—When I went to Java I observed there that they had a very rapid and systematic fashion of dealing with it.

A.1772. So that there are good prospects in that direction?—Yes.

A.1773. With regard to the use of sulphate of ammonia as a manure, do you know of any instance where the use of sulphate of ammonia has effected the tilth?—I asked that question myself in Java and I was told that such cases had not occurred, but at the same time their soil may be such as might resist anything of that kind. But I have no experience here; we have not used it long enough.

A.1774. Would you recommend sulphate of ammonia in unirrigated areas?—I recommend it throughout this tract which is an unirrigated tract.

A.1775. You could not tell us whether that has had any effect on the tilth or on physical character of the soil?—It has not been used long enough in this area for us to gather any data.

A.1776. In your experimental work do you feel that adequate information is not available in regard to the water requirements of cane?—I cannot do

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any work here at Pusa on the water requirements of cane. That would have to be done in the sub-stations in each of the Provinces where cane could be grown. We can only tell you what we can do here on the residual moisture in the soil at the time of planting, the class of cane we can grow, and how to make the best use of the moisture. That we have worked out.

A.1777. You have no plant physiologist in this Institute here?—Not that I know of.

A.1778. Do you not think it would be very useful to have adequate and definite knowledge of what the water requirements of sugarcane are?—I think that work should be linked up with the work that Mr. Henderson has suggested should be done in an irrigated area. It is a work that I should be against trying to start here because I consider that the work should essentially be done in an irrigated district.

A.1779. It should perhaps be under the control of your Bureau?—I would certainly like to undertake it.

A.1780. What is the average percentage of sugar in the variety of cane that you recommend to the grower?—The percentage in juice ranges between 14 to 16, 17, and 19, but, of course, 12 is the minimum which we always demand before a cane is received from Coimbatore.

A.1781. If I remember aright the Sugar Committee recommended a sliding scale, based on a price for cane equal to one-half the price of the sugar produced from it?—Yes.

A.1782. What have you got to say about that recommendation?—I am under the impression that any alteration of scales of payment for cane here at present would be undesirable. At the present moment they pay a flat rate for canes when purchasing them from the small growers. They set their price at a figure beneath which they will not have to go and then they may conceivably raise the price. The small grower carefully considers that rate.

A.1783. Surely, the Sugar Committee knew the particular argument that you were just telling us about, and yet they made the recommendation. Could you tell us the reason of that recommendation?—I think they did it with the idea that it would open the gate to Utopia but I do not think myself that any of the districts is yet ripe to start things of that kind. It may be done by the big growers and educated men.

A.1784. Is *gur* still produced by the ryot in large quantities?—Yes.

A.1785. Is *gur* consumption decreasing?—I have not noticed a general glut of *gur* all over India which would, in my opinion, be the only sign that consumption was decreasing to such an extent that there was not a market for the *gur* made.

A.1786. Is it possible, then, to organise the business of *gur* refining in large factories?—The business of *gur* refining is solely dependent at present on the price of sugar. Whenever the price of sugar rises to £. figure and the price of *gur* falls to a figure at which you can buy *gur* low enough you can make it into sugar at a profit. These factories round here operate during the off-season. They are not always out to make a profit. If they can cover their ordinary charges during the off-season, they are content. But I may point out that this method of working in the off-season has frequently coincided with a drop in the sugar market and the factory has been kept with a product which it cannot sell at a profit.

A.1787. I know what happens. I believe it is due to the fact that sugar is in the hands of speculators and *gur* is not subject to speculation?—I think that we could make it a profitable business if we were to start in Calcutta a futures market such as they have in New York where you can sell your sugar forward. But we have no such market.

A.1788. *Sir Ganga Ram*: You can sell sugar forward?—There is no method by which you can be covered during the time of manufacture as is done in the case of wheat and flour, I believe.

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A.1789. *Professor Gangulee*: With the extension of Coimbatore sugarcane cultivation in India, is there any scope for small sugar factories?—What do you mean by small factories?

A.1790. Factories which are not run on a big scale. We have got only a few large sugar factories in this country?—There are quite a number of them.

A.1791. I think there are altogether 7?—We have got more than that. We have scope here for the smallest factory. I would call it a small factory if it could take about 5,000 maunds of cane per working day.

A.1792. When I say small factories, I mean the factories which can be managed by the growers themselves in co-operation?—I am at present firmly against the grower interfering with the manufacturing side in any way whatsoever because sugar manufacturing is a highly technical subject.

A.1793. The growers themselves will manufacture sugar but they will have a technologist appointed to the co-operative societies?—That is certainly an idea worth considering. At the same time, the process of sugar manufacturing is so specialised that I should be very unwilling to work with a group of growers. A venture of this description should not be undertaken until we have a much increased staff in the Bureau, otherwise the growers will get into difficulties.

A.1794. Do the factories you have here in this Province act as bankers for sugar growers? Do they lend them money?—Mr. Henry will be able to give you that information on Thursday if he is called to give evidence. He does all that.

A.1795. With regard to sugar manufacture, what process do you follow, carbonisation or sulphitation process?—The carbonisation process. The sulphitation process is also followed in other factories.

A.1796. Which is more efficient?—I am answering this question without any experience. I can only tell you that carbonised sugar is supposed to keep colour better and to keep better. Some people think that with sulphitation sugar this is not the case; of course I speak subject to correction.

A.1797. What use do they make of the molasses?—They are supposed to be used for *hookah* tobacco.

A.1798. Are they not used for making alcoholic drinks?—I should think a certain amount of them is used for alcoholic drinks but not a large quantity. I also heard the other day that a certain amount of molasses is used for adulterating *gur*.

A.1799. With the development of sugar factories in the country, would you have to consider the use of molasses?—What about the use of molasses to make power alcohol?

A.1800. *Sir Ganga Ram*: You could make it into molassine by mixing it with megasse?—I do not think there will be a market for it.

A.1801. Have you tried that?—I would if I could sell it to the Military.

A.1802. *Professor Gangulee*: Does your Sugar Bureau organise propaganda such as delivering lectures to the growers or demonstrating cultivation of cane?—I have no staff to lecture.

A.1803. If you had a staff, do you think you could profitably organise propaganda work?—If I had a staff I would certainly set to work at once to organise these people and make them get the canes out three times as fast as they are getting them out to-day. But I have no staff. My two Agricultural Assistants have been taken away from me and my staff has now been reduced to one man on the agricultural side.

A.1804. Do you think a great deal can be achieved by such propaganda?—I am certain of it.

A. 1805. To what extent has the cable service proved valuable in stabilising the sugar industry in the country?—It has proved valuable from the remarks of all the members who are subscribing to it. One of the most frequent remarks made is that, though the report is in the market to the effect that such and such a thing has happened, the individual has always waited

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till the Sugar Bureau telegram came before he was absolutely certain that it was not a rumour. When our telegram comes, they know the information is *pucca*. We do not profess to be able to give the information before anybody else but we always confirm our information. For instance, there was a hurricane in Cuba which caused a great deal of confusion. When our telegram arrived, all the rumours were set at rest.

A.1806. It helps not only the sugar speculators but also the sugar growers?—Undoubtedly, because it stabilises the price of sugar. A large number of merchants who deal in sugar in India are without any first-hand information from other countries. The big dealers have their private sources for the supply of information and, as they use these sources of supply, naturally it is the small man who gets squeezed. He wants trustworthy information at a reasonable figure.

A.1807. Would a large grower of sugarcane get the information from the cable service?—Not unless he owned a factory.

A.1808. So the grower himself cannot get the benefit of the cable service?—It would not benefit him; he is paid a fixed price.

A.1809. *Mr. Calvert*: I notice that these Coimbatore canes are giving widely different results in different places in the same Province?—Yes.

A.1810. That is largely due to different climates and soils?—I should like to say that it might be due to difference of cultivation.

A.1811. Even on Government farms?—Yes, even on Government farms.

A.1812. Could you give us some idea of the number of varieties that you wish ultimately to obtain? Six or eight or a larger number?—I think myself that only in very few Provinces would more than four varieties be necessary. That is to say, one cane for the best lands, an earlier ripening cane for the northern side where you want early ripening, a cane for light lands, and a cane for low and bad lands. That would give you four varieties. If it were a question of specialising the industry, then we should want a cane for each month of the sugar season. But I do not anticipate that that would come to pass for a number of years. As a matter of fact Co. 213 seems to be doing well in most places.

A.1813. In your note you say on pages 171 and 172 that the thing should be explained to the educated growers first and then let it filter down to the small ryot. Is it your experience that the practice of the educated people does actually filter down?—My experience has been as follows. When we first started to give out these Coimbatore canes, we gathered together all the principal growers round here who were mostly Europeans. We then demonstrated to them and they proceeded to grow the canes on their own land. Now they grow these canes by means of ordinary ploughmen, *jamadars* and the usual menial staff we employ here. Next year the Indian zamindars, who are very often the *maliks* of these European factories, wrote to me or came to me, or went to the European growers and asked for seed, and we supplied them with that seed. They then proceeded to put down the areas under their own cultivation in the same way. After that, the local small growers, the *jamadar* class, owning 5 to 10 acres of land, proceeded to take seed from those people, grew it and made a success of it. Then came the last class of all, the ordinary ryot, who saw that the *jamadar*, the man a little above him, could grow it, and he proceeded to get the cane seed and grew it. My experience has been that, if you go directly from a Government farm, where a loss of Rs. 10 an acre is nothing, and you ask the man to whom the loss of Rs. 10 an acre might mean the loss of his capital, to grow it, you are asking him to take a risk, not an agricultural risk, but you are asking him to take a big risk, because the difference between you with your large farm with every facility and that man is so great that you cannot expect him to take your word for it; you are asking him to believe too much. But if he sees his neighbours, large and small, doing it, he will also do it. I think our agricultural farms are too far away from the small ryot.

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A.1814. Normally, going round an agricultural farm, one finds that the boundary of the farm is also the boundary of the system of cultivation. Things do not filter out into the neighbouring farms by themselves?—My impression is that things generally filter out at certain places to certain people who are a little more advanced than their fellow cultivators.

A.1815. Any marked improvement would naturally move quicker than some slight improvement?—I say that no man engaged in agriculture is going to turn round for anything under 20 per cent improvement. These 5 per cent and 7 per cent improvements are no good at all. No practical agriculturist is going to disturb his rotation for a 5 per cent or 7 per cent improvement which is less than the monsoon variation. Give him an improvement like the one we gave them in these canes, and he will jump at it; he is not going to wander about for 5 per cent improvements; as a matter of fact, they are not worth putting up.

A.1816. Can you suggest what arrangements should be made through co-operative societies to finance sugarcane growing? If co-operative societies were formed in cane-growing tracts, would you give them preference in the distribution of seed over individuals?—Distinctly.

A.1817. You further suggest that co-operative societies might be formed for special manure depôts, sulphate of ammonia and oil-cakes. Do you think you could guarantee a profit by the sale of these manures?—I can see no reason why, if you bought manure in bulk and brought it up to a central place, and then gave it out in small quantities, you should not make a profit. It is being done this year by the owner of one factory at Bhicanpur, and it is going to be done by two other factories. I think Mr. Atkins and Mr. Henry, the two gentlemen dealing with this matter here, are conversant with the methods. Mr. Atkins is practically the founder and the maintainer of the most substantial co-operative bank in this district.

A.1818. Actually, I have never yet come across manure which the Agricultural Department guaranteed. The societies would be prepared to stock and sell manures if the department guaranteed the profit?—I think myself that sulphate of ammonia and nitrate of soda could perfectly well be sold in small quantities through reliable people. The factories, I know, are prepared to take large quantities and do it. If it passes through a large number of hands, there is no question but that it would be adulterated, probably with earth.

A.1819. *Professor Gangulee*: Messrs. Shaw, Wallace & Co., sell it direct?—It is the British Sulphate of Ammonia Federation. If you send manure up to a man in the bazaar, he breaks it up into small quantities and adds earth, and the cultivator is not sufficiently educated to detect the presence of earth.

A.1820. *Mr. Calvert*: Actually; the experience of co-operative societies with regard to the manures recommended by the Agricultural Department has been rather bitter?—I do not know. We recommend these two manures here, and we have no difficulties. I am not talking about patent sugarcane mixtures. We are recommending the perfectly ordinary manures; these mixtures I know nothing about.

A.1821. Is sulphate of ammonia produced in India?—It is produced at Burrakar. The last lot came from Burrakar.

A.1822. Is it exported from India?—Yes, to Java. The Sugar Committee's Report says, "As we have already mentioned, the greater part of the sulphate of ammonia produced in India is exported to Java and the Straits Settlements."

A.1823. Then you suggest that co-operative *gur* sale societies might do good. Do you think a co-operative *gur* sale society would be able to fight the ring of the middlemen?—That depends entirely on the size of your society, where it was placed, and whether it was prepared to deal direct with the firms buying *gur* for refining. I think if such a co-operative society deals direct, for instance, with Messrs. Begg, Sutherland & Co., who buy an

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enormous amount of *gur*, they would certainly do better if they cut out the middlemen.

A.1824. Do you not think that it is easier for the middlemen to form a ring than for the people to form a good co-operative society?—I think the middlemen are perhaps better organised than the ordinary people, but that is a thing for the district officials to look into. I see no reason why a large buyer like Messrs. Begg, Sutherland & Co., should not buy direct from co-operative societies.

A.1825. Experience of that has rather been in favour of the middlemen?—Very probably.

A.1826. You have stated that most people in England are interested in farming. That of course is of very recent date?—What do you call recent date?

A.1827. A year or so?—10 or 15 years ago. Even before that time they must have been interested in farming for a long time.

A.1828. From the time of William the Conqueror up to the 18th century there was no improvement in English agriculture?—I think there has been steady improvement, though imperceptible.

A.1829. Practically nothing noticeable. Even in England, Sir Daniel Hall says, the agricultural methods of the Romans are still in vogue?—They have been very good methods in certain districts.

A.1830. The landlord's interest, when aroused, was aroused for the sake of their own pockets?—I think India is a totally different case. I cannot see any sign here of anybody's interest being aroused for the sake of their own pockets. When you come to deal with people of the kind I have referred to in my note, you must remember that their pockets are always filled from other sources.

A.1831. Do you not think that increased profits from land will be sufficient to arouse their interest?—I do not think so. There is one case near here where I think the individual in question has as large a sum of money as he wants, and the only way of stimulating him would be to offer an honour which he has not got at present.

A.1832. On this question, can you suggest any other methods apart from giving honours?—I think if you start at the top and make agriculture fashionable, as I have said in this note, everybody will take it up. For instance, the man I am referring to here, if he were really keen on getting this honour and getting it through his agriculture, would see to it that all the zamindars below him and people of that sort were stirred into life; he is the person who can stir them into life.

A.1833. Having got his honour, what then?—He would then see that all these people did improve things by what they had done. I think you will then find that the question of what he had financially made would become obvious, and he would prefer to stick to it. Once the man has made an improvement, he will stick to it.

A.1834. Your argument is, that in the case of pioneers in agricultural improvement, honours should be given more freely?—My belief is that if India is dependent on agriculture, as we are always being told, agriculture should be made the primary thing for development, and the Honours List does not show, in my opinion, that that is the thing taken into consideration.

A.1835. Suppose you are recommending an honour, would you prefer to see that honour given to the cultivator who had adopted your methods, or to the member of your own staff who had devoted many years to the improvement of a crop?—I should prefer to give it to somebody higher up who could influence the cultivator more than I could do.

A.1836. Mr. Kamat: What should be the principle of distribution of honours? Should they be given to the man who does service to himself by doing his own agriculture, or to the man who does service to the public?—To the man who does service to the public. In the case of the people to

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whom I have referred in my note, they are in charge of large areas of land, and they could be made to stimulate things generally by such honours. I do not expect a Ruling Chief to start farming on his own, but I certainly do think that by means of a judicious distribution of honours, he could be got to take an active interest in the agriculture of his State.

A.1837. You do not think it will be a colossal eyewash?—Still, we must attempt to do something.

A.1838. You have visited Java. Will you please say what the general organisation of Java is with regard to scientific research on cane breeding and other things? How many stations or sub-stations does it have for the size of the country?—It has one station where all the work is carried out, technological, breeding and all other work. The conditions in Java, except up towards the hills and the higher tracts, do not vary to any extent which makes it necessary to have the cane breeding in one place and the technological work in another. Cane breeding goes on in the tract round which factories work.

A.1839. So that organisation will not suit this country; you will require many more sub-stations here?—Yes.

A.1840. Do you mean to say that the ordinary business principles do not come into play in regard to *gur*, and if the price of *gur* here, for instance, is very high, the man at Baramati does not know it?—I do not know for a fact that he does not know it, but I do know this that he seems to make no effort to fill the vacancy.

A.1841. But in the case of other commodities, say for instance grains, if the market for a particular kind of grain in Cawnpore goes up or down, the *bania* for instance, even down in the South, knows that the market is up or down as the case may be; he has his correspondents. Why does not that apply in the case of *gur*?—I do not think that *gur* is a commodity which is dealt in and sold like grains. I think that when you are dealing with food grains, I speak subject to correction, you are dealing with commodities which are easily handled. Most of the *gur* that I have experience of here does not keep during the rains; it becomes a sticky mass; you cannot handle it and send it about; it is difficult to do so.

A.1842. I know it goes from Baramati to places so far away as the Berars?—In that case, if you come upstairs, I will probably be able to explain why this difference in prices exists.

A.1843. It is packed in gunny bags and exported to long distances?—We have upstairs these charts showing the difference in prices. I would like myself to know the reason, but the difference is there.

If the facts are as you say, there should be something like your cable service for internal purposes.

A.1844. Will you kindly tell me something more about the Formosa system of supplying manure?—The system there is that the factory takes the cane from the grower and supplies the grower with manures of a certain kind and takes the cost of that manure, either out of the man's payment for cane or else out of the bonus. The factories in Formosa work with a licensed area; they have no competitor and a fair price is paid.

A.1845. You think that the success of the supply of manure through this system is dependent on licensing?—I think that the supply of manure to the cultivators and everything connected with good cane cultivation is dependent on the guarantee that the factory will receive the improved cane produced by the grower to whom they supply the seed and the manure.

A.1846. Therefore it seems to me it is based on mutual commercial considerations?—Exactly so.

A.1847. Unless you have the licensing, will not the system work here?—I do not think the system will work here because nobody in my knowledge is going to spend money, time and trouble in supplying improved seeds and manures to a man who is not going to supply the cane. They are not philanthropic institutions.

Mr. Wynne Sayer.

A.1848. I know that in the Bombay Presidency, at least, manure is supplied by private agencies?—I do not think these two factories take cane from each other.

A.1849. No; but the point I was going to mention was that there is no guarantee test if the cultivators are dissatisfied with the kind of manure they receive through these private agencies?—No guarantee test. But then the factory is not going to give an inferior manure, for the loss will come back on the factory.

A.1850. You are speaking about an area where there are factories; I am talking of an area where there are no factories. In such a case I want to know whether you have any suggestions to make as to how the cultivator is to get guaranteed manure?—I think the co-operative societies, if they deal direct with the firm, might solve it. They would get their manure in bulk and they would get a perfectly unadulterated article.

A.1851. Will the Agricultural Department undertake to do this?—I think that is a question which you should ask the Provincial Director.

A.1852. I suppose you have seen the Baramati sugar factory. I should like to ask you what, in your opinion, were the causes of that company being shipwrecked?—I would prefer to tell you later.

A. 1853. In *camera*?—Yes.

A.1854. Speaking about import duty; even assuming all circumstances to be favourable and that you carry on research with early ripening varieties of sugarcane and you start model factories, as you propose, in one or two centres in India to stimulate the manufacture of white sugar, do you foresee the time when India can stand competition with Java and other countries in the manufacture of sugar?—I do foresee a time when India can dispense with foreign imports if the problem is attacked vigorously from all sides.

A.1855. If you do, do you think it can stand on its own legs without any import duty as a protective measure?—When the Indian industry is properly organised and developed and is fully efficient, I consider that the protection afforded by the handling of the imported sugar, the freight from a place like Java, the railway freight up to the centre, will be sufficient to protect the industry, that is, when it is fully organised and is on a basis equivalent to that of Java. In saying that I refer to the fact that a factory in Java does not pay two profits. Every factory that I know in India at present pays two profits, that is to say, pays a profit to the cultivator on his cane and then has to make a profit on the sale of its sugar. Java does not do that. The cane comes in at the lowest cost price.

A.1856. In other words you suggest that, for the country to stand on its own legs at some future date, what you will have to achieve is more research on the scientific side, and on the commercial side, organisation such as you say there is in Java; these two things must proceed side by side?—Yes.

A.1857. Do you visualise the time when you will come to the same stage as Java in evolving good types of sugarcane, say, within 15 or 20 years?—I think as we are working at the present moment we shall, if we are given the staff and the money, and the assistance and the opportunity to go to different places and see what other people are doing. I do not see any reason why, with the variety in the different canes at our disposal, we shall not be able to breed the cane for every tract in India.

A.1858. A cane which can stand competition with the varieties in Java?—Yes; a cane which should be able to compete with the varieties in Java subject to the difference between tropical Java and sub-tropical North India.

A.1859. And from that point of view it would be a good investment for the Government of India and the community to take all the steps which you suggest?—I think it will be an excellent investment for the Government of India to put the sugar industry in India on a basis where it could stop the present drain out of the country, roughly 15 crores of rupees for Java sugar, and in addition would enable us to be in a position to supply the ever increasing amount of sugar to those tracts which now consume *gur*. I think in the

time you refer to, 25 years, the tracts in India which now consume *gur* will be demanding sugar and if we are not in a position to supply that sugar from sugar made in India it will be supplied from outside.

A.1860. If it would take 25 years as you say for us to reach that stage, during the interval are you in favour of a protective duty?—I am in favour of keeping the duty as it stands until we have got the industry in a position to keep itself going. I think if we tamper with the duty, or reduce it, or remove it, we shall simply involve the country in a far greater loss than if we had never put on the duty at all and had prevented the industry from expanding. I myself think that the position of things in Bombay should show you that.

A.1861. Would you go even a little further, as you suggested yesterday, and raise the present duty, provided the additional 4 or 8 annas goes to supply the funds for research and other work?—I think that you could raise it to Rs. 4-8 or Rs. 4-12.

A.1862. Even up to Rs. 5?—I do not go as far as that. It will not mean less consumption.

A.1863. You suggest two model factories in India for showing the people how to manufacture sugar?—I suggest one for the purpose of teaching students the process of sugar manufacture. We suggest a model factory for the Punjab so as to get the industry up there organised and to show the ryot that he could make a profit by selling cane to the factory. I adhere to that idea.

A.1864. You would not have a model factory at the Imperial farm?—I would have a small model factory here. If a man is going to learn sugar manufacture he may just as well come up here.

A.1865. By the starting of mere model factories for training would the manufacture of sugar be stimulated in the country? Is that the experience of the Government of India?—My idea is that the manufacturer of sugar in the country would be stimulated if you could get expert staff in the country without having, as at present, to get that expert staff at great expense from outside.

A.1866. I do not want to go into very many instances but I should like to come to one instance which has some bearing on the question. At Dehra Dun, Government started a model plant to show how paper could be manufactured in India. Has it stimulated the manufacture of paper in India?—It has led to the supply of paper made in India available for printing a widely read paper.

A.1867. What I am driving at is this. The mere establishment of a model factory by Government does not necessarily lead to the manufacture of that article or commodity in the country?—When I referred to a model factory I think you misunderstood me. I referred to a factory to show students how to manufacture sugar, the process and that sort of thing, to render them capable of getting jobs as managers or engineers in any sugar factory which is going to be put up, not to show the general public how to make sugar, because it is for those trained students to do that when they are qualified.

A.1868. Have they got many factories to work in?—There are plenty of factories. I do not think they would have difficulty in that.

(The witness withdrew.)

**Dr. F. J. F. SHAW, D.Sc., A.R.C.S., F.L.S., Officiating Imperial
Economic Botanist, Pusa.**

Replies to the Questionnaire.

QUESTIONS 1(a) and 4(a) & (b).—ADMINISTRATION.—The organisation of the existing Agricultural Departments in India is based on the division of the country into Provinces. It is obvious that the different economic, climatic and edaphic conditions which prevail in various parts of the country, and which determine the type of agriculture and the crops grown in any part, are not limited by political boundaries and that a more ideal scheme of agricultural organisation would have based the divisions of the Agricultural Service on a consideration of these factors rather than on the existing provincial frontiers. The organisation which has grown up has resulted in the same problems being investigated in different Provinces by different workers, who are debarred from crossing their provincial boundaries and conferring together on problems of mutual interest. The cause of scientific research has in the past undoubtedly suffered from the infrequent gatherings of scientific workers, whose intercourse has in practice been restricted to the sectional meetings of the Board of Agriculture.

The most efficient organisation for agricultural research and development would be that of a single department for the whole country, the divisions of that department being based on agricultural problems instead of on administrative areas. It cannot however be denied that the creation of such an organisation at the present time would be against the trend of political development in India which is in favour of provincial autonomy. It is probably too late to attempt any such reform but it should not be impossible to devise some scheme which would strengthen the liaison between the different provincial departments and, while leaving them free to develop the work of demonstration and propaganda on their own lines, would assist in securing a uniform and continuous policy of research on the major problems which lie before them.

It appears to the writer to be the duty of the Government of India to undertake the work of co-ordinating agricultural research on the major problems which confront the different Agricultural Departments in India. This could be done by the establishment of bureaux, working under a Research Council. The bureaux would each deal with the research work on one of the major problems and would be charged with the duty of collecting information as to the progress of work in other countries and receiving periodical reports from workers in India. Each bureau would submit reports to the Research Council whose duty it would be to advise the Government of India on the progress made and on the allocation of funds for future work. The bureaux would each require a Secretary, who should be one of the research workers in the subject with which the bureau deals; the Heads of Sections at Pusa could be secretaries in most cases. In the early stages these bureaux could thus be established with very little cost and without withdrawing any officer of the Imperial Agricultural Service from the work on which he is at present engaged. It must be recognised that the work of the Secretary of a Bureau would be of a technical nature and would not involve an officer of the Agricultural Service in administrative details for which he is not suited by training. A bureau would include in its members all the research workers on a particular problem, both officers of the Imperial Department of Agriculture, and of Provincial Departments of Agriculture. Annual meetings of the bureaux would be necessary and would replace the old sectional meetings of the Board of Agriculture. The number of bureaux required would not be large. Sugarcane already has its bureau and the research work on cotton is guided by a committee, probably 5 or 6 new bureaux would suffice to cover all the major problems of Indian agriculture. The bureaux might be allocated to the following problems:—(1) soils, (2) plant protection, (3) cereals, (4) sugarcane,

(5) cotton, (6) industrial crops, *e.g.*, jute, tobacco, oil-seeds, (7) cattle and veterinary, and (8) entomology.

The Research Council should consist of the Agricultural Adviser to the Government of India, the Director of Pusa, the Secretaries of bureaux and additional members, who would be co-opted from Provincial Departments of Agriculture and important industrial interests as the subject under discussion required. A necessary corollary to the establishment of a Research Council would be the creation of a fund which would be used by the Government of India as the Council advised. This fund would be available for :

- (1) Strengthening the number of research workers in any bureau by appointments to the Imperial Department. Such new appointments would not necessarily be at Pusa.
- (2) The establishment and maintenance of research and testing stations, directly under the bureau wherever the Research Council considered that such action was needed to supplement the work of the local Department of Agriculture or to initiate a new line of work which the provincial department was unable to undertake.

In the case of crops which are the basis of big industries, Government might receive financial assistance towards the expenses of research from the industry itself. This has, I believe, happened in the case of jute and recently a commercial firm offered to contribute towards the cost of the tobacco experiments now in progress at Pusa.

With the establishment of a Research Council the Board of Agriculture would no longer have on its agenda subjects of a scientific nature and could adopt a more popular programme and character; it would then be desirable to change the constitution of the present Board of Agriculture so as to include a considerable proportion of non-official members. The best way of doing this would be by the creation of an All-India Agricultural Association the membership of which would be open to all who are interested in the agriculture of India. The present Board of Agriculture might then become a council of the new association; such a council by being open to non-official members would possess an influence in the country which the Board of Agriculture has never attained.

Scientific officers and agricultural officers should be relieved as far as possible of administrative work and when circumstances render it desirable that they should undertake an administrative post they should not be required to do so in addition to their technical duties. In this respect the existence of the post of Joint Director at Pusa is a hindrance to the professional work of the senior officers and the appointment of a full time Director is a much needed reform. The Director should be selected from among the officers of the Indian Agricultural Service, not necessarily from the staff at Pusa, and would take charge of all the details of administration and preside over the Pusa Council. The Joint Director being himself Head of a section cannot at present discharge these functions. This reform would give the Agricultural Adviser, who is at present also Director of Pusa, more time for the duties of the senior post and would allow every section the exclusive attention of the officer at its head.

The Agricultural Adviser to the Government of India should be stationed at the headquarters of Government and should be a member of the Legislative Assembly. He should be provided with three or four assistants, recruited from the senior officers of the Agricultural Service, who would tour throughout India and keep the Agricultural Adviser in touch with the progress of the work of the provincial departments. Some assistance of this nature appears to be essential if the Agricultural Adviser is to carry out the administrative work of his post at headquarters and also to perform the duties of inspection.

QUESTION 2.—AGRICULTURAL EDUCATION.—The only type of agricultural education in India with which I am familiar is the training of post-graduate students at Pusa. The course in economic botany lasts two years and was instituted in its present form in 1925. The section has accommodation for

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4 students so that two students are taken each year, provided candidates reach the required standard. The standard required of candidates is that they should possess a good M.Sc. degree in Botany from one of the best Indian Universities. Up to the present time two students have completed their training and one of these has received an appointment in the Superior Service. The other has only just left Pusa. Two students are at present under training.

I consider that, provided a high standard of academic qualifications is rigorously maintained in the selection of students, the training given at Pusa is more suited to the requirements of Indian recruits for the Indian Agricultural Service than any which could be obtained in Europe. In economic botany, for instance, the student is actually working on the crops which will form the subjects of his investigations in any Province to which he may be appointed. He is also working under Indian conditions of climate and soil and the fact that crops are growing at Pusa during both the rains and the cold weather means that the student does as much in 12 months at Pusa as he could achieve in 2 years in Europe.

The Indian student, who possesses a good M.Sc. degree or its equivalent, is excellent material for training for the botanical side of the Indian Agricultural Service. He suffers however from certain disadvantages in comparison with the product of an English University. These disadvantages are connected with his early education rather than with any defect in the instruction which he has received at his University in his special subject. The English schoolboy leaves his school with a sufficient knowledge of French and German to render the scientific literature of both these countries accessible to him. The Indian naturally has not got this knowledge, since he is compelled to spend a good deal of time in attaining a high standard of English before he can commence the study of any branch of science. The Indian botanical student also receives a much less thorough grounding in the fundamental subjects of mathematics, physics and chemistry than his European colleague; this sometimes leads to an inadequate appreciation of the biological problems which confront him. Of these two difficulties the lack of knowledge of French and German can be remedied by instruction at Pusa. The elementary training in physics, mathematics and chemistry can only be remedied in the Indian Universities.

I think that the students who are appointed to the Indian Agricultural Service after training at Pusa should serve on probation for two years and should then be sent to a University in Europe for one year. By the time that they go to Europe they will have acquired some experience in their subject and will be in a position to derive benefit from the stimulus of meeting new conditions and other workers.

QUESTION 3.—DEMONSTRATION AND PROPAGANDA.—(d) The most striking instances of successful propaganda by the Agricultural Departments are furnished by the spread of the improved seeds introduced by the departments. Among the most successful which have come under my observation may be mentioned :—

- (1) Pusa wheats in Northern India, (2) Pusa tobacco in Bihar and the United Provinces, (3) improved types of jute by the Bengal Department of Agriculture, (4) Coimbatore sugarcane in North Bihar, (5) improved types of paddy produced by the Bengal Department of Agriculture, and (6) the introduction of quick growing varieties of ground-nuts in Khandesh and North Gujarat by the Bombay Department of Agriculture.

The reason for success in these cases is that the ryot is not slow to take up an improvement once it has been demonstrated to him, and provided it does not involve capital expenditure. The improvement of crop yields by the introduction of better seed is however but one side of the propaganda work done by the Agricultural Departments. The preservation of crops from the depredations of those pests and diseases which do so much to lessen the return which the agriculturist obtains for his labour has received close attention and

the application of scientific methods, which are within the financial means of the ryot, has in certain cases, achieved notable results. The fight against the smut disease of *juar* in the Province of Bombay is a case in point. This disease can be prevented by steeping the seed in a solution of copper sulphate before sowing. The Department of Agriculture has introduced the practice of seed steeping among the agriculturists of the Province and there is an annual sale of 40,000 to 50,000 packets of copper sulphate. These packets are offered to the public at a cost of one anna per packet and are supplied with printed instructions in vernaculars and English. It is estimated that this disease causes an annual loss in the Bombay Presidency of about 5-10 per cent of the crop, which is equal to about 10 lakhs of rupees; during the past year seed treatment was carried out over about 350,000 acres and this method is now becoming established as part of the ordinary agricultural practice of cultivators of *juar*.

QUESTION 11.—CROPS.—(a) (i). The Botanical Section at Pusa is primarily concerned with the improvement of crops by plant breeding, that is, the production of new and superior types by selection and hybridisation. A new type may be an improvement on the existing crop because it is—(1) superior in the quality of its product, (2) heavier in yielding power, and (3) resistant to disease.

The third property may of course be a potent factor in the increase of yield. The achievements of the Botanical Section at Pusa, during the past 20 years, have already been submitted to the Commission in the memorandum describing the work of the Section.

Examples of the improvement of crops by selection are afforded by the success of Pusa 4 and Pusa 12 wheats, gram types 17 and 25, linseed types 12 and 121, *Hibiscus cannabinus* type 3 and tobacco type 28. The Pusa wheats, linseeds and grams are superior both in quality and yielding power, and the two former are in many areas resistant to rust disease. The Pusa types of *Hibiscus cannabinus* and tobacco are superior in quality and command a higher price. The wheats Pusa 52 and 80/5 are examples of improvement by hybridisation. Pusa 52 is a hybrid between Pusa 6 and Punjab 9, it is a bearded wheat which is increasing in popularity. Pusa 80/5 is a hybrid between Pusa 4 and Pusa 6, it is still under trial. At the present moment work is in progress on wheat, tobacco, linseed, gram, sugarcane, oats, *arhar* and other crops and new types are being produced by selection and hybridisation.

It should be recognised that there is a limitation to the improvement of crops by plant breeding and that limitation depends upon the indigenous agricultural practice. A heavier yielding type must make greater demands on the soil and its introduction should be accompanied by a change in the local system of agriculture which will enable the soil to regain its fertility. Unless this is done the yield of the new type must inevitably deteriorate until a new balance is struck between crop production and the regeneration of soil fertility; this balance will probably come somewhere about the level of the old yield of the local crop.

The breeding of types which are resistant to disease offers at present one of the most promising lines for the improvement of crops in India. The Botanical Section at Pusa is working on this subject in collaboration with the Mycological Section. At present a joint research is in progress which has for its object the isolation of a type of *arhar* resistant to wilt disease and the types of linseed and gram, which have been isolated in the Botanical Section, are being tested for wilt resistance in the Mycological Section. Further work on these lines will be taken up as opportunity offers when the new types which are being produced in the Botanical Section are available.

The introduction of new crops from other countries is one of the easiest methods of improving agriculture. The new crop however does not always succeed in its new home and under these circumstances an improvement in the local crop may sometimes be effected by hybridisation with the local type. Thus European oats are not a success in Bihar and at the present moment experiments are in progress in the Botanical Section which have for their

object the crossing of these oats with selected local types and the ultimate improvement of the oat crop by the production of a new hybrid oat. A recent importation which has proved a success is that of Adcock tobacco. This tobacco was introduced into India by a commercial company and is one of the best of the American cigarette tobaccos. It yields in India a bright leaf and is being used in the Botanical Section as one of parents in some crossing experiments which have for their object the production of a high grade Indian cigarette tobacco. The crop of Adcock tobacco which is being grown in India under the agency of the company will this year probably cover 12,000 acres and reach a yield of 8,000,000 lbs.

(iii) The distribution of seed of improved varieties of crops is carried out in India almost entirely by the agency of Government Departments of Agriculture. The introduction of the Pusa wheats into the United Provinces and the Punjab was accomplished by raising the seed crop at Pusa, and also on local indigo estates, where the crop was under inspection by the staff of the Botanical Section, and sending the seed to the Departments of Agriculture in the United Provinces and the Punjab. These departments then multiplied the seed on their own farms and distributed it to growers. The use of private estates for the production of seed enabled a very much larger quantity of seed to be produced than would have been possible had the area under the seed crop been restricted to the land available for this purpose on the Pusa Estate, and, as a result, the area under these wheats increased very rapidly. A similar use of indigo estates in Bihar has been made by the Bengal Department of Agriculture for the production of seed of the improved varieties of jute which have been produced by this department. In this case the object of growing the seed crop in Bihar was chiefly to avoid contamination with inferior jute such as might result if the seed were raised in Bengal. The actual distribution of jute seed to the ryots in Bengal was at one time carried out by selling the seed in As. 4 packets at the police *thanas*.

The demand for seed of the Pusa types of wheat, linseed etc., is always in excess of the quantity which can be produced in the Botanical Section. Most of the seed grown in the Section is supplied to the Provincial Departments of Agriculture who thus periodically renew their seed supply and maintain the purity of their product. These Departments of Agriculture multiply the seed and distribute it to ryots in their Province. They naturally maintain a high standard of quality and purity in the seed which is supplied to the public through their agency but there is at present in India no legislation such as regulates the supply of agricultural seeds and protects the purchaser in other countries. In those countries where Seed Laws exist, vendors of seeds are required to furnish a written or printed label containing a statement specifying (1) the commonly accepted name of such agricultural seeds, (2) the percentage by weight of purity or freedom of such seeds from foreign matter, (3) the percentage of germination of such agricultural seeds together with the date of test, (4) the full name and address of the seedsman, dealer, etc. The law holds the dealer responsible for the accuracy of such statements and thus enables the purchaser to inform himself as to what he is buying. Any infringement of these orders makes the dealer liable to punishment.

Seed testing and the certification of seed have now become matters of international interest, and progressive countries have all established seed testing laboratories where thorough and scientific analyses of samples of seed are made and certified for a nominal charge. As long as the supply of pure agricultural seeds is restricted to Government departments such legislation is scarcely needed in India but with the growth of private enterprise some systems of certification of seeds will be required to protect the Indian ryot.

(c) The efforts of the Botanical Section at Pusa in improving crops have been successful in the case of wheat, gram, linseed, tobacco and *Hibiscus cannabinus* and an account of the success of the Pusa varieties of these crops will be found in the memorandum already submitted to the Commission, in-

the Annual Reports of the Section, Memoirs of the Department of Agriculture in India, (Botanical Series), in the Pusa Bulletins and in the *Agricultural Journal of India*. It is estimated that the area under Pusa wheats in Northern India is now well into the second million acres and that the increased profit to the growers is about Rs. 15 per acre. The dividend on this item of work is therefore well over a million sterling a year. The Pusa tobacco type 28 was estimated four years ago to be growing over about 50,000 acres, the value of the crop being about Rs. 25 per acre above that of the local kinds. The Pusa linseeds have given yields about 40 per cent higher than the local type in trials at Pusa and have a good oil content. They are being grown on an increasing scale by an oil crushing factory in Bihar and the demand for this seed is increasing. In addition to the success which has been achieved in India it is worth mentioning that Pusa wheats have taken prizes in Australia and indeed Pusa 4 is one of the wheats distributed by the Queensland Department of Agriculture. The Pusa linseeds have been tried in Iraq with marked success and it is probable that one of these will be adopted by the local Department of Agriculture for distribution. An account of the improved seeds which are now available from the Botanical Section at Pusa has recently been published (*Agricultural Journal of India*, Vol. XXI, page 190, May 1926).

Oral Evidence.

A.1869. *The Chairman*: Dr. Shaw, you are the Imperial Economic Botanist?—Yes.

A.1870. You have prepared for the Commission a note of the evidence that you wish to give. Do you want to say anything in amplification of that note at this stage?—No.

A.1871. Are you satisfied with Pusa as a site for this institution?—Yes. Of course the ideal site for an institution like this would be a place which could grow all the crops in the country and was equidistant from all the important centres; but that cannot be realised. Here, in Pusa, the only disadvantage is the travelling facilities to the place. The communications are bad and there is no reason why they should be as bad as they are at present. They were much better 17 years ago.

A.1872. You mean more convenient connections?—Yes, the railway connections were more convenient than they are now. Otherwise here in Pusa, so far as Northern India is concerned, we are roughly between Eastern India and North-Western India and I think we can grow most of the crops, with the exception of cotton, which are grown all over Northern India from Assam to the North-West Frontier.

A.1873. How about the co-ordination between department and department at Pusa? Are you satisfied with that?—Yes. I have always found it quite easy to co-operate with my brother officers in other sections.

A.1874. Are you satisfied with the touch between Pusa and the Provinces?—Not altogether, because I think, as you will see from my note, the whole organisation of research in India needs revision. The agricultural problems which confront the different Departments of Agriculture are not limited by the political boundaries of the different Provinces and we should have some organisation (I have sketched an outline of the sort of thing that appeals to me) which will co-ordinate the research work on the major problems all over the country.

A.1875. Do you think it feasible, in the face of the Reforms, to attempt to organise research and demonstration in the territorial sense in accordance with the distribution of the crops?—I think so. Perhaps not demonstration; that must be left, I think, to the local Departments of Agriculture, but I see no reason why research work should not be organised under bureaux, such as the Sugar Bureau which you have just examined, and the Cotton Committee. I see no reason why the research work on the major problems should not be organised on those lines.

A.1876. It has been found a great deal more easy to finance the Indian Central Cotton Committee than one would expect in the case of crops which are not export crops?—Yes, that I imagine, is the case. Finance and that sort of thing is not my concern.

A. 1877. Have you anything, other than that which you have set down in your note, which you would like to say about the teaching at Pusa?—I would like to say that considering the fact that agriculture is of such supreme importance in India the number of students studying, say, economic botany, is perhaps from that point of view small. But considering also the fact that practically the only employment for these men when they are trained is by filling the vacancies in the different Government Departments of Agriculture, then I think that the number of students is quite enough. We have more students than there will be vacancies for in Government service.

A.1878. Have you yourself any experience of demonstration and propaganda?—At one time in my service I was stationed in Madras for six months and I had charge there of the spraying operations against the palm diseases on the West Coast. That is practically the only experience I have had. It was only for a short time.

A.1879. Do you think that officers engaged in demonstration can do useful service by bringing to the notice of those who direct research practical problems with which the cultivator is faced?—Yes, I should think so.

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A.1880. Under the present arrangements, as you have told the Commission, demonstration is carried out under provincial organisations?—Yes.

A.1881. Do you think that, under these conditions, demonstrators in the Provinces are in a position to bring to the notice of officers at Pusa problems upon which attention ought to be directed?—Under the present organisation, no. But there is much chance for the people who are engaged in the demonstration work to bring to the notice of the research workers at Pusa those particular points which may catch their attention.

A.1882. Your note is very full and I have at this stage very few questions to ask you. I think my colleagues would like to hear from you what your own training and past appointments have been?—I was educated at the Imperial College of Science, London. I went there in 1904. I took the Associateship in Botany of that college in 1907 and the Honours B.Sc., London University, in 1908. After that I was on the staff of the college under Sir John Farmer for two years and was engaged in teaching and research work. I came out to India in 1910 and was posted to Pusa as Assistant to Dr. Butler. In 1913 I was posted to Coimbatore to fill a leave vacancy for six months. I returned to Pusa at the end of that and I have been here ever since. I succeeded to my present appointment in 1924. I have practically been at Pusa during all my service.

A.1883. Were you at Pusa when Mr. Howard was here?—Yes, for 15 years or more.

A.1884. Did you work directly under him?—I did not work under Mr. Howard at all; I was under Dr. Butler.

A.1885. *Professor Gangulee*: Where did you get your training in plant genetics?—Generally as a part of the botanical course when I took my botanical degree.

A. 1886. But you were originally a mycologist?—I specialised in Mycology when I came out here. I took my D.Sc. in Botany in 1916 at the London University.

A.1887. *The Chairman*: Do you see a great field of work before your department?—I think there is and there always will be, because in my work no finality can ever be reached.

A.1888. The question to decide is which problem you should tackle first?—Yes.

A. 1889. Who, in fact, takes that decision?—The responsibility as to the work that is done in the section rests with myself. But I submit the new work that I take up to the Director of this Institute before starting it. That is the rule of the Pusa Institute.

A.1890. That is, if you come to a point where new work is to be taken up and there is a question as to which of the crops should receive attention, you submit your ideas on the point to the Director and he decides?—That is according to the Pusa rules.

A.1891. Do you know whether the Director decides that question on your notes and his own experience, or does he consult the Heads of other sections?—I think in theory it should be done by the Pusa Council, but in actual practice, of course, when there is a choice between several problems the man who has to do the investigation is always attracted more by one problem than by others, and the Director generally would adopt the suggestion which appealed most to the man who had to do the work.

A.1892. What is the constitution of the Pusa Council?—It consists of the Director and the Heads of the Sections.

A.1893. So that you are a member of the Council?—Yes.

A.1894. When was the last meeting that you attended?—The last meeting was very recent. I think it was convened possibly three weeks ago.

A.1895. I was wondering whether, in your experience, such questions as the way in which a problem is to be tackled are, in fact, submitted to the Council?—As a general rule they are not, and the meetings of the Council have been very few.

A.1896. I suppose these crop problems are very often capable of being tackled in their component parts section by section, as, for instance, the botanical aspect of the problem and possibly the chemical aspect of the problem?—Yes; there is one piece of work which is under investigation by two sections, that is to say, by the Botanical Section and the Mycological Section.

A. 1897. How is that particular experiment arranged for?—The Mycological Section was working on the disease and it really arose out of a conversation between Dr. McRae and myself.

A.1898. It was not co-ordinated by the Pusa Council?—It was not. Dr. McRae was working on it and we discussed the matter and decided to take up the subject from the point of view of plant-breeding and simply took it up. On the other hand, the proposal regarding the tobacco investigation, the study of the American tobaccos and their crossing with the Pusa type 28, was submitted to the Director and it was sanctioned.

A.1899. *Sir James MacKenna*: You consider that, as the provincial departments are strengthened, applications for help to Pusa are likely to be fewer; is that your experience?—I think the applications for help to Pusa become fewer because the provincial departments know that if they make an application to Pusa for assistance, the touring expenses of the officer who visits them would be charged to them.

A.1900. That is a new rule under the Fundamental Rules?—That is a new rule under the Devolution Rules. During the last few years since that rule has been in force, I think there have been hardly any applications for assistance, for a personal visit, by the members of this Institute to the Provinces.

A.1901. So that the Devolution Rules are a very serious limitation on the relations of your Institute with the Provinces?—It is. Even supposing that I have money in my allotment for travelling allowance which would permit of my undertaking a piece of work for a Province, yet, if the Province asked me to do that and even if I am prepared to spend my grant on that work, the Province will have to pay for it.

A.1902. In the old days it was the custom to give short courses of lectures. Am I correct in understanding that they have been stopped under similar rules?—I think the Government do not look with a kindly eye upon them. The only students I have had in that way have been the students in animal husbandry from Bangalore who came here for a couple of months.

A.1903. But these students were under the Government of India?—Yes.

A.1904. I have heard that they have stopped these short courses because the view of the Government of India is that they are a provincial concern. Is that correct?—That is correct as far as I know.

A.1905. In view of all these limitations, do you think it would be possible, without any great financial readjustment, to organise work on some of our scientific subjects by bureaux such as you have suggested to the Chairman; these bureaux would meet regularly, and would consist of representatives of the workers in the Provinces and at Pusa?—That is my idea. I think these bureaux should be organised on the problems and not on the subjects. I would not have a Chemical Bureau but I would have a Soil Bureau.

A.1906. Do you consider the abolition of the sectional meeting to be a mistake?—They died a natural death from the travelling allowance consideration. The Provincial Governments in some cases would not meet the expenses of the officers. I think that was a great mistake.

A.1907. Now on the question of teaching. How many recruits have there been to the Imperial Agricultural Service on the botanical side during the last 5 years?—I am afraid I could not give you the number off-hand, I have no doubt that the figure can be obtained in Pusa.

A.1908. Are they a small number or a large number?—I should say, small.

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A.1909. You could not give us the approximate recruitment for the last 10 years?—I should not care to do that.

A.1910. Would you say that it would be large or small?—I should not think that it would be large, but I should not care to give it. What do you consider to be large?

A.1911. I should consider 20 large?—I do not think it is as big as that.

A.1912. In view of the fact that there are so few posts available in the Imperial Agricultural Service, do you think that undue emphasis is being laid on the question of post-graduate training at Pusa, and would you not be simply providing a course which would very seldom be used?—If the Provincial Departments of Agriculture filled their vacancies from men who have been trained at Pusa, I should think there would be one vacancy in a year and I am supposed to turn out 2 students every year.

A.1913. One of whom may get a job and the other may not?—That is what I had in my mind when I said, a little while ago, that I do not think the number of the students is small when you consider the prospect of subsequent employment for them.

A.1914. You know that it has always been a reproach that little is done in the way of teaching. Do you not think it would be better to give up the present kind of post-graduate teaching and to start something like what is given at the Rothamsted Institute, *i.e.*, courses for specialised workers or refresher courses?—You mean a refresher course, with a view possibly to promote people to the higher grade?

A.1915. Not necessarily. Men in the service might want to go to Pusa to keep themselves in touch with the library and laboratory. There might be study leave courses for the Indian members of the service?—That would not appeal to me. On the whole, I think it is better to go on with the present system.

A.1916. You would rather have a paper scheme which is never filled up with students and which is always a sort of reproach. A sectional Head came before us and told the Commission that he had got two students. Is there any likelihood that the present post-graduate courses will ever be of much importance?—If these men are to fill the vacancies in the Department of Agriculture in India, I think there is.

A.1917. You point out that there are several limitations to Pusa; but, apart from the question of inaccessibility, which is obvious, there are not very many limitations to Pusa as a site for a central institute, beyond the fact that cotton, and of course to a certain extent rice, cannot be grown here?—A lot of rice is grown in the district.

A.1918. Do you think there is a site anywhere in India where one could get a farm where every crop in the country could be grown?—No.

A.1919. So, from that point of view, Pusa is no worse than others?—Pusa is no worse from that point of view. Every place will have some disadvantage; the disadvantage here is the railway communication, which is capable of improvement; it need not be as bad as it is.

A.1920. *Professor Gangulee*: Have you approached the Railway Board with regard to railway communication?—I have not; it is not my job.

A.1921. Do you know if the Institute, as an organisation, has done so?—I do not know.

A.1922. Can you tell us the function of the Pusa Council?—It has to edit the publications and the memoirs; that is its main business; and it discusses matters of general interest, but not very often.

A.1923. Does it publish the minutes of its meetings?—That I do not know; the minutes go to the Director.

A.1924. Do you have a colloquium, where the scientific officers meet together and discuss scientific problems?—We are a small community here, and we all meet one another whenever we are not at work.

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A.1925. There is no regular meeting?—I do not see the need of it. I see all my brother officers every day. It is not needed certainly where all the officers have the same social habits; it might be needed in the future, perhaps.

A.1926. With regard to post-graduate training, to which you have already made a reference, do you consider that the arrangement for post-graduate training at the Pusa Institute is a help rather than a hindrance to research?—It is no hindrance to research at all.

A.1927. Is it a help?—I think it is. I am quite glad to have these men. But I would like to say that I think a very rigid selection is necessary, that we should not take anybody who does not hold a good M.Sc. degree. Having got a man like that into a section for a couple of years, I find him useful, because his training consists in assisting in the work of the section.

A.1928. You had a number of students; could you tell the Commission the scientific qualifications of those students when they came to you?—I have had 4 since the course was instituted in its present form; 3 of them had M.Sc. degrees.

A.1929. In botany?—Yes. The fourth man was from an agricultural college; he had the highest qualification that the agricultural college could give, whatever that is; he came from the Cawnpore Agricultural College. One of these men is now in the Superior Service; another one only left us a little while back, and has not yet got any appointment; the other 2 are working in the section.

A.1930. After they receive their training under you, are you prepared to say that they are quite efficient scientific workers, and that they could tackle problems independent of any direction or any help?—They would be better, as every one would be, by being associated with somebody with wider experience during their first few years of work.

A.1931. At least they go away from here with a scientific outlook?—Yes.

A.1932. And, perhaps, with a bit of initiative?—I hope so, yes.

A.1933. Some of these men, as you say, are being appointed in the Department of Agriculture in various Provincial Governments?—One man from my section was appointed to the Sugarcane Breeding Station at Coimbatore.

A.1934. Recently, as you know, the Universities of this country have been sending out a number of students to various European countries for botanical education. Can you not develop the Pusa Institute as an institute for that sort of work, so that we can send our students to Pusa, not purely for the Agricultural Service, but for economic botany and botanical education generally?—As far as I can see, it is entirely a question of accommodation. I cannot take any more students now.

A.1935. Given the accommodation, could it be done?—Given the accommodation and the staff, it could be done, I suppose. I cannot manage any more now, I am alone in the section.

A.1936. In one word, would you like to see this Institute developed as a post-graduate college for scientific education, with a large number of students, like, for instance, the Imperial College of Agriculture in Trinidad and the Imperial College at Tokyo? Would you develop this Institute, not only for agriculture, but for higher scientific education?—No, I would not; I would keep it to its job, which is agriculture.

A.1937. Would you develop it into a Central Imperial College of Agriculture?—Yes; I should like to see all the men who are appointed to the Department of Agriculture coming from here.

A. 1938. Would you affiliate it to the University, so that you could confer degrees?—I would not affiliate it to the University.

A.1939. *The Chairman*: Not even to the extent of giving a degree on thesis?—I would prefer not to affiliate it to any University.

A.1940. *Professor Gangulee*: Do you think you could attract students to it, without having it affiliated to any University?—Given a reasonable prospect

of subsequent employment, you would not have any difficulty in attracting students.

A.1941. The student gets a certain amount of training here, and he goes to Europe, to Rothamsted perhaps, or some other institute and gets his D.Sc. All the credit for his D.Sc. thesis goes to the Rothamsted Experimental Station whereas you have done the foundation work?—That is true.

A.1942. Many of our students go away from this country to European Universities to get that recognition; would you not raise the status of the Pusa Institute to that of any European post-graduate institution?—I do not think so, because we must keep the technical side of our work before us.

A.1943. With all the equipment and facilities that you have here, you would not develop this Institute in that direction?—Not for general science teaching.

A.1944. I am talking about agriculture only, post-graduate training in agriculture. Would you be content to develop this Institute into a Central Institute for the whole of India? I envisage the time when the people from the neighbouring countries will come to Pusa to study problems of semi-tropical and tropical nature?—I am afraid the development which you suggest would interfere very much with the research work and the activities of this place for the benefit of Indian agriculture. I should like to have, as I said earlier, these 3 or 4 students in the section, but the development which is being suggested would, it seems, entirely alter the character and the usefulness of this place to the agriculture of India generally.

A.1945. You would confine the activities of the Institute to the narrow limits of providing men for the Indian Agricultural Service?—Yes, but I would not exclude a man who was personally interested in agriculture, a rich landowner or anybody like him, from coming here if he wanted to do so, provided there was room for him.

A.1946. Are you in touch with the Economic Botanists of the other Provinces?—I have been in service for a number of years, and I know pretty well everybody in the service.

A.1947. When you are carrying on a piece of research work here, do you have any medium by which you can notify your provincial fellow-workers?—I can write to them, and I do write to them.

A.1948. Therefore, they are in touch with you?—When anybody that I know of in a Provincial Department of Agriculture is working on tobacco, for instance, I am in correspondence with him. I am in correspondence with anybody like that who is working on something on which I myself am engaged. Tobacco work is going on in Bengal, and the Bombay Department keeps a small farm in Gujarat for tobacco work.

A.1949. And they are in touch with you?—Yes; I visit Nadiad and Dacca regularly.

A.1950. Are you in touch with any University Professors who are teaching botany?—I used to have a certain amount of correspondence with one or two of them, but I am not very much in touch with the Universities.

A.1951. With regard to your suggestion for seed testing here, do you feel the need of a Pure Seed Act in India?—Not at present, but I think it will come in time.

A.1952. With the development of plant-breeding work, it is sure to come?—Yes; it will come in time. I do not think there is any need for it at present, because the supply of agricultural seeds is practically restricted to the Departments of Agriculture.

A.1953. Is there any arrangement here for seed testing and certification?—There is no such arrangement; I do it occasionally, when I am asked to, but it is purely a private thing, and I always do it on the understanding that no certificate of mine can ever be dragged into a legal dispute.

A.1954. *The Chairman*: What is your view of the relation between teaching and research?—I have some experience of that in England, and my view is that people who are to be trained to do research must be taught by re-

search workers. I do not agree with the view that is sometimes put forward that we should separate research from teaching entirely. Post-graduate teaching, training of men to do research, can only be done by somebody who is doing research himself.

A.1955. What about the converse effect?—Do you think that teaching has a valuable influence upon research?—I think it has; I think if one has got students to teach, one is compelled to take an interest outside possibly the one or two lines of research which one is conducting oneself. I do not think myself that teaching, provided there is not too much of it and it is post-graduate teaching, has a bad effect upon research. Elementary teaching of course is death to research.

A.1956. *Mr. Calvert*: In continuation of what Professor Gangulee asked you, do you find that University Professors of Botany take an interest in your work?—Yes, I have had correspondence with one of them.

A.1957. Do they come and visit you and see what you are doing?—No, but we write to each other.

A.1958. What, in your opinion, should be the agency for the carrying out of work of indirect economic value, such as plants to prevent soil erosion, or reclamation of land, or things like that?—Of course, all the Economic Botanists of the Agricultural Department have become absorbed in plant-breeding. I should think that would be the work of the Forest Botanist.

A.1959. You would not make it any section of the agricultural work?—No; I would be inclined to give it to the Forest Department. There is no section of the Agricultural Department, as it exists at present, which is concerned with it. You might make a separate section, if it is considered more desirable that that work should be done by the Agricultural Department than by the Forest Department.

A.1960. You have suggested a series of bureaux; would there be any advantage in arranging them in the order of the portions of the plant, that is to say, one for the roots, one for the leaf, one for the fruit or the seed, and so on?—I do not think so. I think the scheme which I suggested for the bureaux was that each bureau should be charged with one of the major problems of Indian agriculture; I think the subjects which I suggested were soils and plant protection, and then the principal crops; that is how I should allot subjects to the bureaux.

A.1961. *Mr. Kamat*: In the scheme you suggest, you propose that the Agricultural Adviser to the Government of India should be a Member of the Assembly?—Yes.

A.1962. At present nobody prevents the Government of India from nominating him; but possibly, as the Government of India feel that they have not the power to initiate anything in the matter of the Departments of Agriculture in the Provinces, they do not think it worthwhile to do so. Unless, therefore, the Government of India, that is, the Member of the Executive Council, feels that he could do something, where is the advantage of having the Agricultural Adviser in the Assembly?—I think, considering the importance of agriculture in India, the Agricultural Service should have a permanent representative at the headquarters of the Government and he should be free to deal purely with administrative questions. He should not be concerned with being the Director at Pusa and he need not necessarily be a man of technical qualifications.

A.1963. What I was asking you was this; agricultural problems cannot possibly come up for discussion in the Assembly as they belong to a Transferred subject. What, then, would be the use of having the Agricultural Adviser in an Assembly which cannot initiate anything at all?—Do you mean that he cannot initiate any discussion in the Assembly at Delhi?

A.1964. Very little at present?—I think that is wrong; that is all that I can say.

A.1965. You think he could do something?—I do not think you are wrong in your statement; but the principle is wrong.

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A.1966. But that is the actual state of affairs; and your scheme tries to change that state?—Yes; my scheme would change that.

A.1967. Then, about your suggestion to have an All-India Agricultural Association; as the members would be drawn from long distances all over the country how is this Association to function?—There would be an annual meeting of the Association and at the same time, in view of the very large distances in India, it would hold local shows in the different Provinces.

A.1968. But, according to you, the membership is open to any one who is interested in agriculture?—Certainly; we want a large non-official element in the Association.

A.1969. Therefore the membership might extend conceivably to, say, 20,000 people and would they ever meet in a general meeting?—No; a meeting of the whole Association would be an impossibility.

A.1970. Therefore, I ask how would your All-India Agricultural Association be useful to the country?—It will have to be sub-divided.

A.1971. Into provincial associations?—It might perhaps not be advisable to sub-divide it in accordance with the existing provincial boundaries; but it will have to be sub-divided.

A.1972. Your aim is to secure advice on agricultural problems?—My aim is to create a sort of public spirit and interest in agricultural research and progress in India. That is what I think such an Association might possibly do.

A.1973. It will not be of any use in solving agricultural questions, or in showing the agricultural needs and requirements of the public. In that respect it might fail. Suppose the public want a solution of a particular agricultural problem. If this Association never meets at all as a body as a whole, how would you obtain the lead from the non-official members?—It could very well be met by delegates.

A.1974. Then it comes to this, that it would have to resolve itself into committees?—Yes; you would have to have committees certainly.

A.1975. Do you think that would be a feasible arrangement?—I think so. I do not see any other way of doing it.

A.1976. *Sir Henry Lawrence*: You referred to some Devolution or Departmental Rules and said that they were a handicap to you in doing the necessary touring. Will you refer me to the particular rule you mentioned?—This is the rule which was communicated to me by the Agricultural Adviser to the Government of India: 'It is the accepted principle of the Government of India and the local Governments that whenever an extra expenditure is actually incurred by the Central Government on account of the services rendered to Provincial Governments by one of its officers, a claim for it can be raised on the Provincial Government, and *vice versa*. Acting upon this principle, the Audit Department insists on claims being made on Provincial Governments for any expenditure incurred by the officers of this department in undertaking any work or tour at the special request of provincial departments. If you so desire it you may make use of this information in your reply to the Questionnaire of the Royal Commission on Agriculture.'

A.1977. *Sir Ganga Ram*: Is that a departmental rule or a Devolution Rule?—It is not a departmental rule.

A.1978. *Sir Henry Lawrence*: There is no mention of a Devolution Rule in this statement?—No. I think we should be allowed to tour for the purpose of consultation with another officer of another department who is engaged on the same line of work.

A.1979. *Sir Ganga Ram*: On invitation or on your own initiative?—One would naturally write to the man who is engaged on the same line of work as one's self, and suggest that it would be desirable to meet for the purpose of discussing and working together. If an officer at Pusa were to put up, as a reason for going on tour, the fact that he wished to discuss his work and its possible line of further development with another officer engaged on the

same line of work, I do not think that tour would be sanctioned. Touring for the purpose of consultation with another officer engaged in the same line of work would not be sanctioned.

A.1980. *Sir Henry Lawrence*: But you are not debarred by any Devolution Rule that you are aware of?—I do not know the Devolution Rules.

A.1981. They can only be altered by the Government of India and the Secretary of State?—I understood that these rules which prohibit us to a certain extent were Devolution Rules. I must say I have never read the Devolution Rules and I do not suppose I ever shall.

A.1982. This order merely refers to a ruling of the Audit Department?—I think the Audit Department acts on the Devolution Rules.

A.1983. *Sir Ganga Ram*: Do you see any possibility of breeding wheat seed to suit the soil of Bombay and Madras in place of *cholam*, *bajri* and other winter crops?—I am afraid I do not at present.

A.1984. You do not see any possibility of it?—Not of extending the cultivation of wheat into the tropical areas of Madras and Bombay.

A.1985. Has any research been made about it?—I do not think so.

A.1986. You think it is not possible?—I should think it would be impossible.

A.1987. But do not you accept the American principle that if the soil does not suit the seed a seed must be discovered to suit the soil?—Certainly.

A.1988. Then why do you call it impossible?—There are limits to that. For instance, I do not think it would be possible to produce a variety of paddy which would grow in Scotland.

A.1989. I want to ask you specially about wheat. You think there is no possibility of introducing wheat in the place of *cholam*, *bajri*, *ragi* and others in these two Provinces?—I think that the temperature in these areas would render it impossible; that is my opinion.

A.1990. Have you any experience of dry farming?—No.

A.1991. Have you visited any such place in America?—No.

A.1992. Do you think that the quantity of water has an effect on the yield of a crop?—In my experience in Pusa it has a very big effect.

A.1993. You mean the greater the quantity of water you use the more the yield?—We do not irrigate here.

A.1994. Say, in irrigated tracts; have you made any research on that subject?—I have had no experience of irrigation at all.

A.1995. I do not remember seeing it in the *Agricultural Journal*; but did you read the account of Mr. Howard making experiments in my village, Gangapur?—I have the file in my office.

A.1996. With two waterings, where they generally give four waterings, he produced a 25 per cent greater yield of wheat; that, I think, was due to harrowing. What do you attribute the success to? Do you think the real reason is that it is due to harrowing?—I should not like to give an opinion on that, because I have not seen it. I was not concerned with the experiment itself at all.

A.1997. Do you know that 140 inches of water is given for sugarcane? Is that a good practice?—I am afraid you are getting me off my subject. I do not know about irrigation.

A.1998. *Sir Thomas Middleton*: You mentioned that in putting up certain proposals (specifically in the case of tobacco cultivation) you submitted them to the Director?—Yes.

A.1999. That is, I presume, mainly for budgeting purposes, it is quite necessary that the Director should know what money you are likely to need?—It is also with a view to preventing overlapping and with a view to co-ordination of work between the different sections. It is not a rule which is very strictly observed, I think.

A. 2000. I should suppose it would be necessary to bring to the notice of the Director any such proposal which is likely to add considerably to the cost of your work?—Most certainly.

A. 2001. Otherwise the work of each section is practically independent? Each Head of the department is working independently?—Yes.

A. 2002. So that Pusa really represents a group of research institutes in the sense in which we use the term 'research institute' in Britain?—No. I think that is taking an extreme view of the case because, as I mentioned earlier in my evidence here, we are alone in a small place. We are all together every minute of our lives and there is nothing to talk about except our work. That is the saving thing with regard to the point which you are raising now.

A. 2003. For example, your plant-breeding work here represents work which is being done at Cambridge, Edinburgh and Aberystwyth?—Yes, from that point of view. I misunderstood you.

A. 2004. Similarly with regard to the work in the Chemical Department?—Yes.

A. 2005. You have insisted in your evidence on the need for more frequent meetings between research workers?—Yes.

A. 2006. You propose to secure that object by organising the work in bureaux?—Yes.

A. 2007. The distances in India are very great, and the difficulty of getting gatherings of considerable size is also great. Do you not think if you had these eight stereotyped bureaux, it might prevent research workers meeting as frequently as they ought, rather than have the effect of bringing them together?—I cannot say that that point of view had occurred to me.

A. 2008. I ask for this reason; we have a Research Council, as you know, in Britain; we are organised more or less on the lines of your bureaux; we did think at one time of arranging meetings of the separate groups, but we found that in fact the interests were so numerous that much more frequent meetings could be arranged if a few workers who were engaged on a specific point were empowered to meet as and when the necessity arose; that is how we solved the difficulty?—Yes; I do not see that that is fundamentally opposed to what I have put forward in my note.

A. 2009. It is not fundamentally opposed, the object is the same?—Yes.

A. 2010. But the effect of organising by bureaux might be to prevent the very object you have in view; at least, this is what we have found in our experience. The fact is that the more you attempt to classify on paper the subjects on which agricultural research workers are engaged, the more difficult it becomes to arrange for frequent meetings?—Yes, certainly.

A. 2011. Your whole object would be secured if by some means it was understood that workers would meet frequently and their expenses could be met?—That would go very far towards securing what is my object in this note, certainly.

A. 2012. In connection with the training of Indian students you referred to some disabilities under which they labour. One is the obvious one that French and German are not languages that are taught in the schools, and you think special measures should be taken to overcome that difficulty?—Yes; at the last meeting of the Pusa Council we discussed that point and the possibility of obtaining a tutor in French and German. At the present moment in my own section I try to give a little instruction in German to my students.

A. 2013. But the more serious difficulty seems to be the lack of grounding in mathematics, physics and chemistry?—Yes, that is the more serious difficulty.

A. 2014. There would appear to be no inherent reason why that particular difficulty should not be removed?—No, there is no reason why that should not be removed, but we cannot do anything to remove it here. We can do something with regard to French and German.

A.2015. You are pointing out that the training is defective?—That is the defect in the Indian University training as far as the students who come to us are concerned.

A.2016. In answer to Prof. Gangulee you said you would rather not have any association with a University; do you not think it would greatly add to the attraction of Pusa from the students' point of view if they were able to take a degree as the result of their study here?—I am afraid of that sort of thing interfering with the research work of economic value which we have to do. You see a good many of our investigations are of a kind on which I do not think a University would give a degree.

A.2017. I ask for this reason; we have at the present time, I suppose, 20 or 30 research students in training in Britain in connection with agricultural work, and of those who go to Cambridge I suppose quite half will take a degree while they are pursuing post-graduate studies; from the student's point of view the possibility of qualifying for a degree certainly adds to the attraction of the post-graduate course. So far as I have heard, there has been no difficulty raised from the standpoint of the institutions?—I was speaking purely of my own section. My section is more difficult from that point of view than any other, because our work is on plant-breeding, as you know, and a problem in plant-breeding takes a long time to complete. It is very much more feasible in some of the other sections.

A.2018. We have the difficulty which you indicate in plant-breeding, but you have the advantage over the British plant-breeders that you can put through two or more crops in a season?—Yes.

A.2019. In Britain we have one crop in a year to deal with and therefore it is not a very suitable subject for a research degree?—Yes. I might give you an instance from the work going on now in the section. In the cold weather of 1924 or 1925 one of my students took up some cross-breeding work in gram; that particular student only got as far as the first hybrid generation in the next year. The present lot of students are carrying on that work but they will not finish it. I should think three generations of students will have passed through before that work can be published.

A.2020. That applies to your own section; not necessarily to other sections?—It does not apply to other sections to the extent to which it does to mine.

A. 2021. *Professor Gangulee*: But even in your own section students could undertake certain research dealing with plant-breeding. Take, for instance, the morphological character of *arhar* flowers; one of your students could undertake that problem and see what relation exists between the morphological structure of that flower and immunity of the plant from diseases?—Yes.

A.2022. You will agree with me that that is a problem which could be undertaken by a post-graduate student, and it is a suitable subject for a thesis?—Yes, provided he is going to stay there for four years; four successive seasons I should think would be required before you would be absolutely certain which way the resistance to disease was going with a particular morphological character. We have now had two seasons and I think we want two more.

A.2023. *Sir Thomas Middleton*: But, from what you have already said, I think you would agree that so far as the giving of instruction in plant-breeding is concerned, you are more favourably situated under Indian conditions than you would be in a temperate climate?—Yes, I think so.

A.2024. You have a wider range of crops and a more rapid growing season?—That is why I consider we are likely to get better results by training men here for the Agricultural Service than by sending them to Europe.

A.2025. *Dr. Hyder*: Are these students whom you are training here in receipt of scholarships, or are they probationers?—I will answer that ques-

tion afterwards if I may. Some have scholarships and some pay their own way; I really could not tell you how many off-hand.

A.2026. *Sir James MacKenna*: There are no scholarships given by Pusa?—I do not think so.

A.2027. *Dr. Hyder*: With regard to your being linked up with other officers working in the Provinces, would it suit you if you had an opposite number, say with regard to botany, in all the Provinces, and your correspondence were officially recognised?—I am able to correspond with them now.

A.2028. But you are not able to meet them?—I do not say I have so much difficulty in meeting them as they have in meeting one another. You see I can, subject to certain limitations, tour all India, but the man, for example, who is working on tobacco in the tobacco farm at Bombay cannot very well go to the tobacco farm at Dacca.

A.2029. So that the chief thing is to bring these men together?—I think so.

A.2030. Under you? Is that the idea?—I do not necessarily wish to put myself at the head of a hierarchy of Economic Botanists.

A.2031. With regard to this question of post-graduate teaching I am going to read to you a Resolution of the Imperial Conference of 1926, and I will ask you whether you agree with the principles laid down there, "The first requisite in a candidate for scientific service is a thorough grounding in science in its broadest aspects; it is only on the basis of such a training as is given by a well-conceived honours course in science at a University that a superstructure of specialised training can be soundly built"—I agree with all that.

A.2032. "The sub-committee welcome the increasing importance which Universities are attaching to research and the tendency to emphasise the essential connection between higher teaching and research work." Do you agree with that?—I agree with that, certainly.

A.2033. Where does Pusa come in here?—I think we do both the higher teaching and the research work.

A.2034. On a sufficiently large scale?—About 90 memoirs of a botanical series of the Department of Agriculture in India have been published. Of these about 50 have been written by officers working in the laboratories at Pusa.

A.2035. You say officers; do you mean students?—No, I mean officers of the Indian Agricultural Service.

A.2036. But we want more memoirs from the students?—Yes.

A.2037. I mean this has a bearing on the training of students?—Yes.

A.2038. The members of the Agricultural Service are quite capable of looking after themselves, but what would happen if you all disappeared?—I do not quite follow your question. Do you mean that the post-graduate students here should have more chance of publishing work?

A.2039. Yes?—As I have just endeavoured to explain to another member of the Commission, in my own particular subject it is almost impossible for a man who comes for a two years' course to carry through a line of work to a point at which he can publish it. When the particular example which I mentioned just now is published I shall edit it as a joint effort of all the men who have been engaged on the work. In my own particular subject I do not see how a man can publish a piece of work which is his own in the two years that he is with us.

A.2040. The Resolution already referred to says further, "Specialised study necessary for scientific officers should be mainly of a post-graduate nature." Is that right?—I do not see how it can be anything else.

Dr. F. J. F. Shaw.

A.2021. And again, "In accordance with the usual practice of Universities such specialised study should be taken under men who are engaged in research in the fields concerned." Now I put you this question: If we sent men from the Indian Universities to you who had a good grounding in these subsidiary subjects, would you like to take these men to train under yourself?—In what capacity?

A.2042. As post-graduate students of the section?—But surely that is what we are doing now. I take my post-graduate students from Indian Universities. I take men who have already taken an M.Sc. degree, if possible. Is that not what you mean?

A.2043. I meant that, but you take only two men. Can you not take more?—I have not the room for more.

A.2044. If you were given more accommodation and equipment?—Yes, if we were given more accommodation and a larger staff, instead of taking only 2 a year we might take 4. But I should not care to take more than 4 because I should not feel that I could give my personal attention to more than that number.

A.2045. As regards representation in the Assembly, this matter has come up not only in your evidence but also in the evidence of another gentleman. Do you know that an official member in the Assembly, unless he happens to be a Member of the Viceroy's Council, has got to leave his ideas and opinions outside the door? He has simply got to sit and vote quietly. That is what an official member does?—That is highly regrettable indeed.

A.2046. *Sir Ganga Ram*: Do these post-graduate students, who come to you, come with an eye to getting Government service or do any of them come with a view to starting work on their own? Do you get these students from the talukdar and big landlord communities?—No; that I think is one of the most serious difficulties. Practically every student who comes to us comes with the idea of getting subsequent employment under Government and what, in my opinion, is needed in India is that the big Indian landowners should be more inclined to send their sons for training in agriculture.

A.2047. That has not been done yet in the case of talukdars and such like people?—No application has yet been made to me by a man who would not at the end of his course have accepted a Government post, had it been offered to him. One of the students I have got at present in the section has a certain amount of landed property, but he would certainly take up a post in the Superior Service if it were offered to him. I do not think that I have had anybody coming to me for training with the deliberate idea of returning to the parental estate and increasing the outturn of his home farm.

A. 2048. *Professor Gangulee*: Would you express your views on the working of the Board of Agriculture?—The Board of Agriculture has not been, in past years, of very great interest to scientific officers of the Indian Agricultural Service because its constitution is such that it is scarcely possible to discuss technical problems such as scientific officers have to deal with. The Board of Agriculture has been concerned more with administrative questions and, very largely, with questions about cattle. As far as I am personally concerned, in recent years the Board of Agriculture meetings have been rather dull. That is all I can say.

A.2049. Do you think it can be revived and made a very useful institution?—No. I think the Board of Agriculture would always find its time taken up with discussions of an administrative nature. It is not a suitable body for the discussion of scientific questions.

A.2050. Would you like to revive the Sectional Conferences?—I should like to revive the same sort of things as meetings of these bureaux which I have suggested. I think that is a more profitable line.

A.2051. *Sir Thomas Middleton*: Assuming that in the future a demand were to arise for post-graduate training in your subject, do we understand

that the limit of 4 students which you have mentioned is due to the lack of teachers and of laboratory accommodation, and that there is no limit imposed by the facilities which the natural conditions of Pusa offer, or by the problems which remain to be tackled?—There is a limit by the natural conditions which Pusa offers. In stating that the maximum number that I could take would be 4, I was supposing that the botanical area which you have visited this morning is to remain the sole area available for my work. Given increased laboratory accommodation and an extra staff I should take about 4 students a year. If you go beyond that, you have got to give me more land, that was the point.

(The witness withdrew.)

Dr. W. McRAE, M.A., D.Sc., Officiating Imperial Mycologist, Pusa.

Replies to the Questionnaire.

QUESTION.—1 (a) (i) The Central Government will always be deeply interested in agriculture which is the main employment of the great majority of the people of India. Some of the activities of the Central Government towards the improvement of agriculture are being carried out directly in the Agricultural Research Institute at Pusa, the Imperial Institute of Dairying at Bangalore and the dairy farms at Karnal and Wellington and indirectly by the levy of cesses on exported cotton and tea in order to provide funds for the Central Cotton Committee and the Indian Tea Association to further the many interests connected with those two crops. If Government would levy a small cess on the other main exports of agricultural produce such as food grains, oil-seeds, fibres, tobacco, coffee, rubber, spices and manures, an income sufficiently large would be secured to enable Government to finance operations to further agricultural improvement in its widest sense to an extent commensurate with the need.

For the administration of such a fund an Advisory Board might be set up representative of the various interests. It would consist of members representing the Departments of Agriculture in British India and the Indian States, members for local agricultural interests and for trade and manufacturing interests. It would be an All-India body. Its function would be to initiate and encourage research, experiment and demonstration, to examine schemes of work and to allocate the necessary funds to carry them out. The organisation is intended to supplement the work being done by Departments of Agriculture in the Provinces and States. It is in no way meant to relieve Provinces of work they should and can do; it is meant to help where help is required. Permanent secretaries would be required who might divide the activities somewhat as follows: (1) crop-production and improvement, (2) animal husbandry, dairying and fodder-crops, (3) finance, economics and co-operation, (4) irrigation and engineering, and (5) crop protection.

The secretary in charge of crop protection would deal with plant diseases, insect attacks and the destruction of crops by wild animals. An example may be taken as to how such an organisation would function with respect to a disease. After considerable observation it has become established that mosaic disease of sugarcane exists in several varieties of cane in certain centres in most of the Provinces of India, *e.g.*, the Punjab, the United Provinces, Bihar, Bengal, Assam, Bombay and Madras both on thick and on thin canes. The disease is widespread in position but its extent is not yet known definitely. The immediate problems that need elucidation are (1) what is the extent of the disease in the various cane growing regions, (2) what loss does it cause, if any, and (3) how is it spread and to what extent.

The requisite information about the first point can be found best for each Province by the staff in that Province. The other two points should be worked out jointly by the staff in the Imperial Department and those in the Provinces and States. Adequate experiments to find the possible loss will have to be done in tropical India on thick canes and in Northern India on thin canes. At present experiments are being done on thick canes at Coimbatore and on thin canes in Pusa but what is being done in other Provinces is not yet known. A definite co-ordinated set of field experiments is required in various parts of India by several workers. Unnecessary duplication along some lines of work due to ignorance of what is being done elsewhere would be eliminated and necessary duplication along other lines would be properly provided for. Much laboratory work has also to be arranged according to the skill and interest of the several workers and the facilities available or capable of being provided and money may be required to finance these activities.

The Advisory Board would form a committee of Entomologists, Plant Pathologists and Agriculturists taking care to see that the fullest contact was made with all the interests concerned. The committee would formulate a scheme of work; see what staff was available in the Provincial, State, and Imperial Departments, allocate the problems amongst them and estimate what amount would be required of the Advisory Board's funds to supplement what could be provided by the Provinces and States. The report would be approved or modified as the case might be by the Advisory Board which would allocate the necessary funds or as much as was available. The members of the committee would carry out the parts of the scheme allocated to them and report progress periodically as might be arranged to the secretary for crop protection who would keep each individual of the committee and other persons interested informed of the progress of the work. Meetings of the committee would be arranged when necessary. Each individual worker would be responsible for writing up his own work for which he would get due credit in publication and the compilation of the final report would be the duty of the secretary for plant protection. With such a scheme Directors of Agriculture in Provinces and States and all persons interested in disease problems would know exactly where to go for information, as to what had been done and as to the progress of work being done and, what would be an inestimable boon, could make arrangements for being supplied with information from time to time as it became available. The responsibility for the means for bringing to the notice of cane growers whatever methods or measures have been worked out for the amelioration of the effects of disease usually falls on the local Agricultural Departments who might be helped in certain circumstances as required.

The scheme depends entirely on the provision of an adequate fund to be placed at the disposal of the Advisory Board. Advice backed by financial help will always be eagerly sought after but without the financial lever the advice of such a Board would not, I think, receive the consideration due to it.

(b) Work awaiting funds:

- (1) Study of soil fungi. The soil is not simply a congeries of particles packed together more or less firmly but it is teeming with various organisms that have a beneficial or a detrimental influence on the plants growing in it. The rôle of bacteria in the soil has been investigated to some extent and a considerable volume of helpful knowledge is at the disposal of the agriculturist. That certain fungi work on the organic and inorganic matter in the soil to make it available as plant food there seems to be little doubt, but this subject remains still to be studied in India. Some harmful fungi in the soil such as members of the genera *Fusarium*, *Pythium* and *Rhizoctonia* have been studied to some extent because they attack the crop itself but much remains to be done on this whole subject which is of economic importance.
- (2) Study of sugarcane diseases. So important has this subject become that a special staff would find full employment for a considerable number of years. The new canes bred at Coimbatore have opened up possibilities of disease resistance that would repay consideration.
- (3) Study of fungi parasitic on the rice plant. Many fungi are found parasitic on paddy in certain circumstances. Occasionally one of them causes appreciable loss in restricted areas. Such a case was the outbreak of *Piricularia* in the Papanasam taluk of the Tanjore district in South India in 1917. Great damage was caused over 1,700 acres but next year fortunately the disease was absent. Though the necessity is not immediate, I think a mycologist should take up the investigation of the fungi on paddy as a form of insurance. If ever a disease became epidemic on paddy and could not be restricted, the loss

- would be too appalling to contemplate. We should, accordingly, be prepared with a full knowledge of what fungi are present and of the reactions of the plant to them.
- (4) Diseases of cereals require far more intensive study than they have had so far in India, e.g., the life-histories of some of the smuts on *bajra* (*Pennisetum typhoideum*), *juar* (*Andropogon sorghum*), *Kodra* (*Paspalum scrobiculatum*), *sawan* (*Panicum frumentaceum*) and rice are not fully known.
 - (5) Diseases of vegetables have been touched very slightly.
 - (6) The virus group of diseases of which mosaic is an example has received little or no attention but the problem has become urgent on sugarcane.

QUESTION 2 (xi).—A two years' course in plant pathology is provided and two students each year can be taken. Students who have a science degree of an Indian or foreign University or a degree of an agricultural college in India are eligible. Those who have done well in botany are chosen. Plant pathology is not usually taught in colleges and Universities as such so that post-graduate students taking the course know only such examples of the main groups of fungi as come within the course in botany. What is essential besides the knowledge and the training that the subjects of a degree course provide is a good knowledge of plant anatomy and plant physiology and where that is present there is no inherent difficulty in giving the requisite training in plant pathology within the time to fit a student for a post in a mycological laboratory so that he can take up research work. During the two years, however, most of a student's time is taken up in acquiring knowledge of facts and methods and only simple problems in investigation can be undertaken. Provided a student has a good scientific education and has the spirit of investigation the course is sufficient to train him to the point where he can begin research work himself. Men who undergo the post-graduate course in mycology look for employment in two directions, to the Universities as lecturers in botany and mycology and to the Departments of Agriculture. The present method of recruitment is suitable for the first but does not adequately meet the needs of the latter. It would be preferable for Directors of Agriculture or whoever be the recruiting authority for the Province to choose from among the diplomats of the agricultural colleges or graduates of the Universities or others the men they wish trained in this subject for their Provinces. Such men would be training for a definite post and would not be hampered by uncertainty as to their future and the fear of unemployment. After passing through the course they should have a few years service in their departments and if their work justified expectation they should be sent to a foreign college for a year or more according to circumstances to undertake a definite line of study. They would go with a personal knowledge of the work they had to do in their own localities and with a mature mind capable of estimating new methods, of appreciating new points of view and of measuring themselves with their fellow-workers. The cost would be well repaid by their increased value as investigators in the realm of plant pathology.

Seeing that the standard systematic work in mycology, Saccardo's "*Sylloge Fungorum*," is written in Latin and that much of the best work along certain lines is written in German and French, a knowledge of these languages should be considered a necessary part of the mental equipment of a mycologist. A language teacher ought to be appointed to the staff at Pusa for the benefit of post-graduate students and tuition in these languages ought to be part of the training. Students in other subjects than mycology would be benefited equally. The students in my section at present endeavour to learn to read descriptions of fungi in Latin and German but the time at my disposal to help them is so limited that a special teacher for the purpose is really required.

Considerable benefit would accrue to the Research Institute if a whole-time Director were appointed. At present the Director, being also Agricult-

tural Adviser whose duties and responsibilities outside the Research Institute have increased very considerably in recent years, has only a part of his time to devote to the Institute and is away from Pusa for a considerable period each year. The Joint Director is immersed in the minutiae of administration and being also Head of a Section has not the time nor the authority to devote to general questions that affect the sections. Besides a whole-time Director, I feel sure, would relieve research officers of much administrative work of a routine nature that at present dissipates their energies and leads to much waste of time and sometimes to a loss of keenness. The present organisation is at best a make-shift brought about for reasons of economy which have now disappeared.

QUESTION 13 (i).—A paper on the "Dissemination of Parasitic Fungi and Internal Legislation" by Dr. E. J. Butler discusses the methods by which fungi that cause plant diseases spread over comparatively short distances as from Province to Province or State to contiguous State and also over long distances as from continent to continent or State to State separated by a wide ocean or very high mountains. The spread of plant diseases is brought about by the transference of spores and *mycelium* by means of the wind, water, animals, insects and man. The *mycelium* of a parasitic fungus does not as a rule live long in the absence of the plant on which it grows and is thus of comparatively little significance as transferable infective material by the agents mentioned except man. Spores, produced usually in enormous numbers in exposed positions, are the main materials disseminated. All the agents can transfer spores for short distances but only birds, insects, wind and man can carry them long distances.

Long distance or discontinuous spread may be considered first. Migratory birds and insects sometimes travel very long distances and spores have been found in large numbers on parts of their bodies. Particles of dust comparable in size to that of spores have been blown for thousands of miles after being carried into the upper air by volcanic outbursts and violent storms. It is natural to expect that spores would be carried in this way too. Were this so, the diseases which they cause would be world wide. But a consideration of the distribution of the better known plant diseases does not justify this supposition. The evidence is circumstantial but it is so substantial in volume that we may take it as a workable proposition that infection by spores carried through the air from remote countries is not a contingency that need be taken seriously into account.

There is abundant evidence, however, to show that many plant diseases at first confined to limited areas have, owing to the activities of man in transporting seed and living plants over long distances, been carried to regions in which they did not previously exist. Examples are the black rust of wheat, the late blight of potatoes and the leaf-disease of coffee, which have followed their respective host plants into most countries into which they have been introduced as a crop, and the mosaic disease of sugarcane once confined to the eastern tropics now occurs in almost all cane-growing countries. Nearly every introduced crop in India has one at least of the diseases to which it is subject in the country from which it came. Some years ago a case occurred in Coimbatore when a small parcel of sugarcane setts from abroad arrived at the Cane Breeding Station with pineapple disease which does not occur in Coimbatore nor has it been found anywhere in India.

In early days, when means of communication were scanty and voyages long, the discontinuous spread of plant diseases was slow but at the present day steam has speeded up communications to such an extent that almost every region of the world has been brought so close that parasitic fungi can live during the time required to traverse the intervening distances and as soon as airships become an established means of communication the last deterrent in time and space will have vanished.

Parasitic fungi, then, travel in association with their host plants but, as the fungi themselves cannot be effectively dealt with directly and in

many cases cannot be detected by an examination at the port of entry, the remedy lies in the proper control of the importation of the host plants with a view to see that the plants come in free from disease. Fortunately India is geographically particularly well situated from the point of view of controlling imports. On the north the Himalayas are practically impenetrable and the other boundaries are ocean girt. Only through Baluchistan, and the eastern boundaries of Burma is access available by the continuous spread of fungi. Across the narrow strait from Ceylon, too, it is possible to receive infective material but Ceylon has a well administered Pest Act, so India is protected quite effectively in that direction.

In 1914 the Government of India passed the Destructive Insects and Pests Act and subsequently made several notifications under that Act.

In forming the list of diseases to be guarded against one has to take into consideration (1) the destructive diseases likely to be imported, (2) the fact that the degree of destructiveness in one country is no certain indication as to the possible virulence when a disease is introduced into another country and (3) the fact that too exhaustive a list would be irksome and hampering to trade. The first consideration is dependent on our knowledge of diseases in other countries. The most destructive diseases are known in most progressive countries but a great deal has to be done in every country and especially in countries where scientific methods are hardly yet applied to increase the knowledge of parasitic fungi especially on economic plants. It is such diseases that have been listed in the notifications because we fear they will be destructive in India. To meet the possibility of a disease of little account in another country being destructive in this country there is no provision in the notifications for we have no criteria by which to judge which are the likely ones and they could only be guarded against by the total prohibition of imports of all living plants, an ideal position which India is not ready for yet, though fortunately she is even now to a large extent self-contained in the way of most crops and important nursery stock of an economic value. The list of diseases is a modest one and the application of the measures of the Act cannot be said with the least degree of truth to be hampering to trade. Briefly the items are:—

Potatoes against wart disease.

Hevea rubber plants against *Fomes semitostus*.

„ *Sphaerostilbe repens*.

„ *Fusicladium macrosporum*.

Sugarcane „ Root-diseases.

„ Pine-apple disease.

„ *Sereh*.

„ *Gummosis*.

„ Mosaic.

„ Fiji disease.

Coffee and *Hevea* to be imported from America only by the Madras Agricultural Department.

The strategy of the Act is to tackle the disease beyond the frontier by seeing that plants are free from specified diseases when they start on their journey to India. Dependence is placed on a certificate from a phytopathological institute supplemented in the case of potatoes by the consignor's certificate. In the case of coffee and *Hevea* rubber an additional safeguard is provided by having the certificated plants come to a definite agency in India (the Madras Agricultural Department). While in the case of Fiji disease of sugarcane resort is had to total prohibition from the countries in which the disease is known to exist.

As in all preventive measures, it is difficult to get direct evidence on which to form an opinion as to the efficacy of the Act, but it is significant that the diseases listed have not come into India though imports of all the host plants have been made since 1914 when the Act came into force.

Dr. W. McRae.

The officials whose duty it is to see that the regulations are complied with are the customs officers at the various ports. So long as they act literally, make no exceptions and fearlessly refuse entry to consignments not fulfilling the regulations then the Act is being efficiently administered. In the declaration form given to passengers on entering an Indian port for the purpose of customs duty no mention is made of the restrictions on the import of seeds and living plants and this is a possible means by which a parasitic fungus might evade detection because of the lack of knowledge of a passenger. A note in the declaration form would be useful.

Certain scientific officers are by notification granted some specified exceptions to the restrictive provisions and this is safe as each officer has available both mycological and entomological advice but any other exception not granted by notifications is a source of danger. For example certain potato growing districts in Bombay are dependent on the annual importation of Italian "seed". This seed was by notification granted exemption from the production of the consignor's certificate that the plants were not grown within five miles of an infected field. Last year suddenly a consignment of potato seed from Germany was landed in Bombay without a certificate and exempted by an order of a secretary to Government. Germany is one of the countries badly infected with wart disease the one against which protection is sought. Thus it has come about that the provisions of the notification have become nugatory and afford no protection against wart disease of potatoes. Only by notification should any modification be made and no exception should ever be given that is not actually mentioned in the notification.

(ii) The continuous spread of plant diseases within a country or a continent is quite a different matter. Here all the agents of dissemination play a part in spreading infective material for shorter or longer distances and season by season extend the area affected and most of the agents are at best only partially controllable.

With the more accurate knowledge of the cause and the progress of disease many methods have been devised to meet the need for combating the multitude of diseases to which plants are subject. Some of the more important are enumerated. It is of course just a list of methods not by any means exhaustive and very often more than one of these methods is adopted against any one disease.

1. Killing the causal organism on or in the plant, *e.g.*, steeping seed of *Sorghum vulgare* in a 2 per cent solution of copper sulphate against smut and exposing potatoes to a temperature of 80° F. to kill the *mycelium* of *phytophthora incestans* that causes late blight of potatoes.
2. Cutting off affected parts of a plant, *e.g.*, pruning *Hevea* rubber against pink disease, coffee against *die back*, fruit trees against various stem and branch diseases.
3. Uprooting and removing affected plants, *e.g.*, roguing potatoes against wilt, sugarcane against mosaic.
4. Using protective sprays or dusts, (a) applied to the plants, *e.g.*, spraying coffee with Bordeaux mixture against leaf-disease, spraying *Hevea* rubber with Bordeaux mixture against second leaf-fall, spraying vines with Bordeaux mixture against mildew, spraying arecanuts with Bordeaux mixture against *mahali* disease, dusting grapes with sulphur against powdery mildew, dusting seed of *Sorghum vulgare* against smut, steeping wheat seed against smut, painting cleaned wounds of trees against several diseases such as coconut palm against bleeding disease; (b) applied to the environment, *e.g.*, soil sterilisation with formaline against damping-off of tobacco seedlings, sterilisation of implements as knives in the operations against bud-rot of palms and flowers, bags, etc., after steeping seed.

5. Avoiding susceptible varieties and using resistant varieties, *e.g.*, Pusa 4 wheat in the North-West Frontier Province because it is resistant to rust and stands up to the wind, changing from *shaftal* to *berseem* as a fodder because the latter is liable to an epidemic leaf-disease, substituting Bombay gram for Burma gram to avoid wilt, substituting exotic varieties of ground-nut (from the United States, Japan, Mauritius, etc.) to escape *tikka* disease.
6. Practising crop rotation in order to starve soil fungi such as *Fusarium* and *Rhizoctonia*.
7. Avoidance of disease bearing material as in selecting setts of sugar-cane for planting.
8. Avoiding manure on which diseased plants have been thrown especially with regard to garden crops.
9. Avoidance of disease infected localities, when getting seed or new stock.

Self-interest makes the grower attend to the various methods enumerated except perhaps in the last cases where he may not be so careful to safeguard his neighbour's interests. There, in very special cases, legislation would be beneficial:

- (1) in legalising a campaign against a disease with a view to confine it within limits,
- (2) in suddenly providing measures for dealing expeditiously and drastically with a newly imported disease,
- (3) in stopping the movements of possibly infected plant material out of a badly infected area or into a disease-free region.

The campaign against the bud-rot of palmyra palms in the Godavari, Kistna and Guntur districts has been carried on for nineteen years. In 1908 the death rate was 80,000 per annum, in 1920 it was 8,000 but in 1925 it was 17,000. The disease has not been eradicated and it is an example of the extraordinary difficulty of suppressing a disease once it has a good hold. What has been done is to reduce the magnitude of the loss and to restrict the spread.

The second benefit would be had if a disease like that of wart disease of potatoes got into India. Nothing but prompt measures carried out drastically would give any hope of success.

The third possible use of legislation is very limited and would be applicable in only a few special diseases that were carried almost exclusively on the plant parts and not by spores and where the locality to be protected or defended against was peculiarly isolated. Madras is the only Province in India that has a Pest Act but I think each Province should consider whether it should have the legislation to enable these measures to be carried out if they became necessary. Celerity being an important factor in the initiation of the operations it would take too long to assume powers after the necessity arose. Within the borders of India legislation as a means of plant protection is of very restricted value. The study of the fundamental problems of diseases in relation to their host plants and the environment, the working out of all possible methods of attack or defence and above all teaching the cultivator that the losses from disease in his crops are preventable and that the means are within his powers is the true way of dealing with diseases that are already within our borders.

Oral Evidence.

A.2052. *The Chairman*: Dr. McRae, you are Officiating Imperial Mycologist?—Yes.

A.2053. We have your note of evidence before us. Do you want to say anything of a general character at this stage?—No.

A.2054. Your note is very full and I have really very few questions which I wish to ask you. I think that we should like to hear about your own training and past appointments?—I got the M.A. degree and subsequently the B.Sc. degree at Edinburgh University. After the final B.Sc. examination, Professor Farmer asked me to become his Demonstrator in Botany in the Royal College of Science, London. I was there for two years, when I got the appointment of Supernumerary Mycologist at Pusa. I went to Germany for 7 months, most of which time was spent at Munich where I studied plant diseases in Professor Freiher von Tubeuf's Laboratory. I was in Pusa for a year and 9 months as Supernumerary Mycologist, then I went to Coimbatore as Government Mycologist for Madras. In the last year and a half of my stay in Coimbatore I acted as Principal of the College; I was transferred to Pusa in 1920, since when I have been here.

A.2055. Do you think that this site at Pusa is one which is suited for the work which is being carried on in the institution?—Mycologically, it is suitable. There is only the difficulty of its position; certainly a site south of the river, on the main line, would be more convenient both for us and for visitors. But so far as my work is concerned it is rather a good place. It is intermediate between the Western belt and the Eastern belt and we can grow the crops of both sides with the result that I have command of a large number of crops on which to study diseases.

A.2056. Are you satisfied with the degree of co-ordination between section and section?—Yes. We meet continually. Whenever something goes wrong with the agricultural side of my work, with the field experiments, I go at once to the Agriculturist and he comes to my assistance. When I have got to carry out a field experiment I go to the Agriculturist beforehand, consult him and arrange with him as to when and where the field experiment can be done. The same is the case with the Botanist, the Chemist and the other Heads of Sections. So that, whenever I want help, I have no difficulty in getting it, likewise I am equally ready and willing to help the others.

A.2057. How about initiating new directions of research? Is the officer in charge of a particular section left to himself in that matter?—To a very great extent he is. For instance, a disease breaks out somewhere but there is no foretelling when it is going to occur, nor can we be forewarned about it. If however it is a new disease and unforeseen expense is likely to be incurred, naturally one has to discuss the matter with the Director and see if operations can be carried on. But in the nature of my work, a good deal must be left to the Head of the Section, for one is very interested in some diseases and not quite so interested in others, and there is no particular reason why that should not be so.

A.2058. You do not think that there is a danger that the Head of a Section may tackle a particular problem because it interests him and lay aside problems which although they may not interest him, are of more pressing economic importance at that moment?—I do not think he would be allowed to do that. When the Director came to know about it through our monthly, annual or tour reports he would immediately bring pressure to bear on the Head of the Section.

A.2059. How about the touch between Pusa and the Provinces?—Until the last six years we used to have sectional meetings. We had three such meetings in Pusa, held once in two years. Then came the great financial stringency when it was difficult to get Mycologists from the Provinces to come to Pusa and the meetings were held in abeyance. A meeting was due again this year but had to be postponed owing to the Agricultural

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Commission. At any rate there is no inherent reason against holding these meetings. The members were debarred from coming because of the difficulty of getting the money for their travelling allowances. With only one officer in the section I do not get about the Provinces as much as I should like to. Whenever I can get an opportunity I tour in the Provinces, I meet the Mycologists. Discussions with them about the work afford much mutual benefit. I get help from them and they get help from me.

A.2060. On occasions when you show signs of proposing to go to the Provinces, are you ever frightened by the bogey of these Devolution Rules?—If one is careful in writing down reasons for a tour one can get round the objections. The diseases that I am working with in Pusa are found in most Provinces in India so that I can go on tour to extend my knowledge of them. Madras, however, is the only Province whose diseases I am not actually working with but I can get to it also because I am responsible for the diseases of the Cane Breeding Station. Generally one has got to be very careful in planning one's tours. One does not go quite as often as one would like because of the rules, but I have never proposed a tour which has been stopped because of audit objection.

A.2061. Do you get sufficiently early information from remote districts of the incidence of any new disease?—It is very difficult to answer a question like that. Diseases have been there for so many years. The only way to get information is when a person living in a remote district comes in contact with an officer of Government or some one in touch with such an officer. I will give you one instance of my experience in Madras. A ryot from the south of the Presidency came with a box of specimens of grapevines that were covered with the loveliest specimen of mildew; we knew the disease which is common in France; we told him that we could not do anything that year; but that when he pruned his vines the next year, we would come and spray them; we did that and we were successful. The reason for his appeal to us was as follows. The Industrial Department was trying to persuade people to use oil engines to pump water out of their wells and an overseer who was fitting up a pump had a copy of the agricultural calendar published in Madras. In this calendar was a note in vernacular about the smut of *juar*. The man wondered if this plant-doctor who wrote the article had not a medicine for the vine disease. He put the specimens in his box and came to Coimbatore. At the pruning time we sprayed three gardens, one once, one twice and the other three times. He found that two sprayings were sufficient. Next year every one wanted to purchase the sprayers and gradually as sprayers became available they were bought. All that we promised to do was to send a man there each year to put all the sprayers in order at the beginning of the spraying season.

A.2062. That was a good illustration of the utility of propaganda in the vernacular, was it not?—Yes.

A.2063. Is not that a good point on behalf of the literacy of the cultivator?—Yes.

A.2064. Are you satisfied with the present arrangements for protecting India against the importation of plant diseases?—I am satisfied with them.

A.2065. Are there any occasions, in connection with your own field of working, in which it would be of any advantage if it were possible to control movements of vegetable substances from one Province to another?—I do not think there is very much field for that except in special diseases in special localities. The wind blows spores about so much that I do not think very much can be done in that way.

A.2066. Have you anything that you would like to tell the Commission about post-graduate training in Pusa? You have probably heard the evidence given by the previous witness?—Yes and I do not think I have very much to add. In my subject, students come with probably the minimum amount of knowledge for any post-graduate course in the Institute. I have had four post-graduate students so far. Two of them were B. Ag.'s, one was a B.A. of Calcutta and the other was a B.Sc. of Aberystwyth, Wales.

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A.2067. Did you hear Dr. Shaw's evidence in full?—Yes.

A.2068. Did you hear his views about the inadvisability of linking up this institution with the Universities for the purpose of conferring a degree?—Yes. So far as the post-graduate students are concerned, I think there is no need for it. Each student has had a science degree from a University or from a college affiliated to a University. If he produces a thesis on the work done in Pusa, he can get a D.Sc., Ph.D., or M.Sc. from his own University.

A.2069. Without any special arrangement?—I do not know about the details.

A.2070. If special arrangements were required for that, would you advocate such special arrangements being made?—Yes.

A.2071. Are you familiar with the constitutional position under the Reforms?—I have only the ordinary man-in-the-street's knowledge.

A.2072. Do you think it is conceivable that the advice of Pusa could be forced upon the Provinces in any way?—Only in one way.

A.2073. In what way?—If the advice is backed up with money grants. There is no other way.

A.2074. *Sir Ganga Ram*: Do your experiments arise out of your own initiative or do the Provinces refer their problems to you?—Both. Once a year I write to every Director in the Provinces and ask him if there are any problems that he would like taken up in Pusa. Sometimes he says he has none; sometimes he says he has. Sometimes I take up the work and at other times I cannot.

A.2075. Before undertaking any experiment, do you keep yourself well informed whether the same experiment has not been conducted in any other Provinces?—Yes. We get the annual report from every Province and in this some mention is made of all the work that is being done, besides I am in direct correspondence with the Mycologists.

A.2076. *Sir Thomas Middleton*: Have you made a general review of the incidence of plant pests throughout the country?—We have not gone very far in that direction. For a long time the only Mycologists were in Pusa and Coimbatore and it is only within the last 5 years that we have got men stationed at Poona, Nagpur, Cawnpore and Mandalay. Each man now is making a list of diseases of crops for his Province and that is one of the subjects that I hope to bring up at the next Conference. In Pusa we have got a card catalogue of all the fungi known to cause disease in India, in which is recorded the locality from which the fungus comes and the Director of the Imperial Bureau of Mycology has in hand the publication of a list.

A.2077. So there is need for some such review and you are thinking of bringing the subject up before the next Conference?—Yes.

A.2078. In connection with the recruitment of officers to the provincial departments, you suggest that the best plan would be for the Director to recruit a graduate and send him to Pusa for some post-graduate instruction. Then, after he has been sometime in the service of the department, he might visit some foreign University for further study?—Yes.

A.2079. As an alternative to that, do you not think it might be a better plan if the Director offered a few scholarships to the most promising graduates in his Province and sent these scholars to Pusa for a post-graduate course and made his selection after they had been through the post-graduate course at Pusa. You have pointed out that the amount of knowledge of mycology which students have on coming to Pusa is practically nil and it must be difficult for the Director to make a selection before serious study has begun?—More depends on the kind of man than on the amount of knowledge at that stage. All the students that have come to me have come with a view to using mycology as a means of earning a livelihood. During the last 20 years there has been, taking posts of every kind that might be called somewhat higher, only half a mycologist's post vacant per year. In some Provinces there have been no appointments. If a man came

from Bengal, there is no Mycologist there and he has little chance of getting into Madras or the Punjab. So, what I fear is that the Director would give scholarships to half a dozen men and he would only choose one. I think it would be better for him to wait until he found the right kind of man before he tried to post him. At this stage I admit that he cannot say whether a man is going to be a good research worker and that after he has been through the course at Pusa, the Director is in a better position to estimate his worth. Later on, if he is going to be a really good man, he needs the experience of another University; that is my general idea.

A.2080. Your idea is largely based upon the fact that the number of appointments is so very small?—Yes.

A.2081. Do you not think there is room for a considerable increase in the number of Mycologists in the provincial departments?—Talking practical politics, I doubt if there will be any great extension at the present moment.

A.2082. Is there room for more Mycologists, having regard to the depredations of fungi alone?—The field is inexhaustible. I think there ought to be one more mycological laboratory in North-East India. For instance, in the Assam-Bengal group disease work can be done from Pusa to a certain extent but not adequately. I think that a man stationed in an area is necessary to gain the detailed knowledge which only residence in the locality can give him. I think extension of staff should take place in this way and that a nucleus of three mycologists should be maintained in Pusa. Just now we have got only one.

A.2083. *Sir James MacKenna*: Have you any relations with the mycological work done at Tocklai in the tea estates?—I have no direct relation; I have only seen Dr. Tunstall's work.

A.2084. Is it a fact that Dr. Tunstall has been brought out to investigate one particular mycological disease?—Yes, but he did so well that he has gone on to investigate other diseases.

A.2085. There is not much inter-relation between Dr. Tunstall and yourself, except that he consults your library?—Dr. Tunstall does all the work on tea. He comes to Pusa chiefly to consult the library and the herbarium with regard to the naming of his fungi, because we have got a very good library and herbarium.

A.2086. What are your relations with the Bureau of Mycology in London?—So far, we have sent all the specimens of fungi to it, because Dr. Butler has got far better facilities for getting them named; we leave all the naming to him, and he primarily deals with that. Sometimes, he cannot do it in London, but he gets the best men on the Continent or in America to do it for him. Last week we had a case where he got a fungus named at Trieste.

A.2087. The Bureau of Mycology is of very great value?—It is of very great importance.

A.2088. And you think that the Government of India contribution should be continued?—I think so. When I went Home last year, I met Dr. Butler, who had come back from visiting mycological institutes on the continent. He knows exactly what is going on there, and I had a long talk with him. We can get information from him about men whom we cannot actually see, but whom he has seen and who are interested in the work. Then, his *Review on Mycology* is a most useful publication because he gives quite a long summary of each article reviewed.

A.2089. Is it not a fact that a mycologist is a botanist extraordinary?—Yes.

A.2090. The slow development of mycology in India is not due to the fact that there are not enough trained Botanists?—I do not think it is very slow as compared with European countries; it is slow as compared with America.

A.2091. There are as many in India as there are in England?—Probably more.

A.2092. Therefore, there is no great point in multiplying the number of post-graduates, unless from the technical side?—A post-graduate student usually looks for employment.

A.2093. So long as you can find a job for him, you may train him up?—Yes.

A.2094. A mycologist is a super-botanist; he must be a first class botanist before he can be a mycologist?—Yes.

A.2095. *Professor Gangulee*: At the same time, you agree that it is necessary for any worker in India, for instance, a plant breeder, to know something about mycology?—Yes.

A.2096. What is your relation with the Pathological Institute in Holland?—I have no direct relationship with it; we send them specimens of fungi occasionally.

A.2097. Have you paid a visit to that Institute?—No.

A.2098. Do you get invitations from International Congresses and Conferences convened by those people?—Yes.

A.2099. Do you send any papers to them?—I have never sent any paper to them.

A.2100. Are you continuing the work carried on here by Dr. Butler?—Yes, I am carrying it on. We are collecting fungi and giving descriptions of the fresh specimens and the measurements of the fresh spores before we send them to him. In that sense we continue the work.

A.2101. You are aware that Dr. Butler's work is the foundation of Indian mycology?—Yes.

A.2102. With regard to your own work here, you say that mosaic disease is widespread in India, but its extent is not yet known definitely. Are you not able to get the information that you want to have through the co-operation of the Provinces?—Yes.

A.2103. Most of the Provinces except Bengal have a Mycologist?—Yes.

A.2104. Through the co-operation of the provincial Mycologists, can you not get the information that you want to have as to what is the extent of the disease, what loss it causes, how it is spread and to what extent?—They are finding out these things now. I have come back from a tour in Madras, and I know that the Mycologist there knows how far round his stations the disease exists; that has also been done in the Central Provinces.

A.2105. With regard to mosaic disease, I was very much interested in what you showed us this morning. Are you carrying on any experiments on any fundamental questions like the problem of the susceptibility or resistance of canes to this disease?—Yes, we have been doing it since last year.

A.2106. Is there any variety of sugarcane which is immune to attack from mosaic disease?—One of the main objects of my work on this disease is to find this out. There are several varieties of canes, that are not attacked but whether they are immune or not we do not know because we have not had time yet to test them.

A.2107. Is the *Uba* variety susceptible?—Mosaic has been observed on *Uba* at Gurdaspur in the Punjab. Another similar disease, streak disease, has been observed on *Uba* at Aligarh in the United Provinces and Gurdaspur.

A.2108. You breed, as I understand, standard canes free from mosaic disease?—Yes.

A.2109. Are you in touch with the plant-breeding section when you carry on this work of finding out the mosaic resistant varieties? Are you in touch with the breeding department in Coimbatore?—Yes; I am responsible for keeping the Cane Breeding Station free from disease. I was there twice last year.

A.2110. You have already made a reference to the Destructive Insects and Pests Act. Can you tell the Commission whether you are satisfied with the operation of that Act?—It is very difficult to judge whether it

has been carried on well or not. It is carried out by preventive officers, who are skilled in preventing things from coming into the country. If a living plant arrives without a certificate these officers do not let it in but send it back or destroy it. We cannot get the work done much better than that.

A.2111. That of course is meant to protect us against foreign infection. What about internal infection? Do you think it is possible to have any legislative measures against the dissemination of these parasites within India?—I have mentioned that in my note. There is not very great scope for it. It is in special cases only that we can hope to control the spread of a disease.

A.2112. With reference to specific diseases it is possible, but not generally applicable?—Yes.

A.2113. *Mr. Calvert*: Is any work possible in the direction of introducing diseases for the destruction of weeds which we do not want, such as water-hyacinth?—We tried probably about 50 fungi on water-hyacinth, but it did not become infected by even one.

A.2114. It is disease-resistant; is that the case with similar weeds like lantana?—I do not say there is no hope, but the work on that particular problem has not been done in India to any great extent.

(The witness withdrew.)

The Commission then adjourned till 10-20 a.m. on Wednesday, the 12th January, 1927.

Wednesday, January 12, 1927.

PUSA.

PRESENT :

The MARQUESS OF LINLITHGOW, D. L. (*Chairman*).

Sir HENRY STAVELEY LAWRENCE,
K.C.S.I., I.C.S.
Sir THOMAS MIDDLETON, K.B.E.,
C.B.
Rai Bahadur SIR GANGA RAM, K.T.,
C.I.E., M.V.O.
Sir JAMES MACKENNA, K.T., C.I.E.,
I.C.S.

Mr. H. CALVERT, C.I.E., I.C.S.
Raja Sri KRISHNA CHANDRA
GAJAPATI NARAYANA DEO of
Parlakimedi.
Professor N. GANGULEE.
Dr. L. K. HYDER.
Mr. B. S. KAMAT.

MR. J. A. MADAN, I.C.S.
MR. F. W. H. SMITH.

} (*Joint Secretaries.*)

Mr. T. BAINBRIGGE FLETCHER, R.N., F.E.S., F.L.S., F.Z.S.,
Imperial Entomologist, Pusa.

Replies to the Questionnaire.

QUESTION 1.—(a) (i) and (ii) So far as entomology is concerned I consider that this science should not be studied as a separate entity concerning only agriculture or veterinary research. Besides these departments, entomology is intimately connected with forestry, medical science, zoology and commerce (under which heading may be included all Government departments and the general public interested in the protection of all kinds of stores from the depredations of insects). Therefore I consider that all research work in entomology should be carried out by a properly organised entomological service. Proposals to this effect were put forward by me ten years ago (*vide* Appendix K to Report of the Indian Industrial Commission) and subsequently, in reply to criticism that my original proposals were on too modest a scale, I submitted in July 1920 a revised note* of which a copy is attached hereto. This scheme, after acceptance of its principle by the Governments and departments concerned, was shelved in 1922 on the ground of financial stringency. I have already shown elsewhere (*Proc. Fourth Entl. Meeting*, pp. 10-11; 1921) that the annual losses caused by insects in India reach the enormous figure of two hundred crores of rupees, this figure disproving any idea that entomology is a minor science of little practical importance to the welfare of the Indian Empire. As I said then, "If we, by a study of insects and by practical application of the knowledge gained thereby, can save even one per cent of this enormous wastage of the national wealth of India, such a saving would more than justify the most complete expansion of entomological work that we can possibly imagine."

In reply to this question, therefore, I submit that the Commission will inquire into my scheme for a properly organised service for the prosecution of research work in entomology and will lend it their powerful support if it appeals to them.

* Not printed.

As regards general obstacles to progress in research under present conditions, I would draw the attention of the Commission to the following points:—

- (1) The time of most so-called research workers is so occupied with routine and other work as to leave very little time for fundamental research. This is partly due to the large increase of work during the last twenty years without any concomitant increase of superior staff (in the case of the Entomological Section at Pusa this staff has been reduced) and partly to the large amount of clerical work which has to be got through.
- (2) The regulations, which have been brought in of recent years, regarding touring, which practically prevent the Pusa staff visiting the Provinces, as was done formerly, and also the Provincial staffs from visiting Pusa as often as is desirable, thus accentuating want of co-ordination on account of want of knowledge of what is being done in other localities.
- (3) Dissatisfaction of the present staff with rates of pay and allowances and a general feeling that there is no appreciation on the part of Government of good work.
- (4) The regulations regarding budget allotments militate against economic use of the money provided. There are special difficulties regarding the obtaining of rare books which are essential for research work.
- (5) The climatic conditions at Pusa prevent an output of work which could be attained under better conditions, besides presenting unnecessary difficulties in the upkeep of collections, books, records, etc.

(b) The main need at present is for more skilled workers and for greater co-operation between workers. So far as concerns the research necessary as the foundation of all successful economic work, both these requirements can be best met, in my opinion, by the centralisation of research workers, together with their apparatus, leaving to the provincial staffs the application of economic work, founded on such research work.

As regards problems on which sufficient progress is not being made, please see the list already given in my note, of July 1920, regarding proposals for expansion of entomological work.

Of the agricultural problems therein included, the subject of borers in sugarcane has already been worked out at Pusa so far as concerns the local fauna of the surrounding district, but we can have still to accumulate very considerable information regarding all the cane-growing districts of India. The subject of boll-worms is also being investigated by the Government Entomologist in the United Provinces, but, here again, what is required is much more information from all over India. Tea pests in North-East India are dealt with by the Entomologist to the Indian Tea Association, but this officer is a non-official and we know very little of what is being done, whilst the tea districts of North and South India are outside of his scope.

The forest pests which require special investigation at present are pests of (1) *sal*, (2) conifers, (3) teak, (4) South Indian forests and (5) stored timber and fuel.

Some medical problems in which entomological work is required are (1) mosquitoes, (2) Muscid flies, (3) fleas, (4) *Kala-azar* investigations.

Veterinary work is directly concerned with insects as pests of animals and carriers of animal diseases. The groups of *Tabanidae*, *Oestridae*, *Muscidae*, *Hippoboscidae*, fleas, and lice and the problems of transmission of diseases such as surra and rinderpest are of especial importance.

On the commercial side, there are important problems connected with insect damage to army stores, railway sleepers, tobacco factories, etc.

Besides the economic aspect of the above groups of insects, it is necessary to provide for progress in the study of their bionomics and systematics,

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without which economic work must fail to be really permanently useful. "Catch and kill" methods, when damage is already being done or has been done, may impress the general public from a spectacular point of view, but are of very little permanent value, even as demonstrations; what is required are permanent control methods, founded on a knowledge of insect bionomics, which may be applied as a regular routine to prevent damage being done.

(c) I cannot suggest any particular subject for research which is not being or has not been investigated to some extent. Such methods of control as the dusting of crops by means of aeroplanes are still in the experimental stage in America and further data must be awaited before we are in a position to try such methods in India.

QUESTION 2.—(i) There is not at present in India any institution or teaching staff *ad hoc* at which or by which a really satisfactory course in entomology can be given. If this question refers to purely agricultural education, I consider that the instruction in elementary entomology given to students in the agricultural colleges was fairly satisfactory on the whole, but the present regulations for touring have prevented my conducting the usual examinations of these students for some years now.

(vii) As regards the agricultural students in the provincial colleges, I do not suggest any modifications other than that included in my scheme for an Entomological Service, *viz.*, to send a Lecturer from the central Entomological Institute to give a short course of lectures annually to the students at each provincial agricultural colleges and, if necessary, to inspect the entomological courses at the colleges and to keep them up to the mark. Such a type of lecture-course would ensure efficiency, by using the services of a specially picked man equipped with the latest facts, and economy in the preparation of specimens, models, diagrams, lantern-slides and films, etc., this course of lectures being, of course, supplementary to the regular course of instruction.

As regards the present course of training at Pusa it is quite evident that it is impossible (apart from any question of teaching staff) to train to Imperial Service standard, in the short period of two years, a student who starts with only an extremely elementary knowledge of entomology. The Conference to consider post-graduate training at Pusa, which was held during the Board of Agriculture Meeting in 1921 and at which I was present, considered only training in agriculture (*i.e.*, farming) and no mention was made at that Conference of any regular course in entomology. Had this been done, I should have pointed out at that time the inadequacy of a two-years' course. If training to Imperial Service standard is required, a proper course must be worked out and a proper teaching staff be provided. Students eligible for admission to post-graduate courses under the present rules may not only lack practically all knowledge of entomology but they also lack any knowledge of the languages (French, German and Latin) which are essential for acquiring a knowledge of published work in any branch of research which they may wish to take up. I should hesitate to give any definite period as a minimum for the necessary training of the present type of student; but it has to be taught languages, which are essential, as well as all the other subjects (such as insect morphology, physiology, development, taxonomy, etc.) which necessarily precede a course in applied entomology—and instruction in both pure and applied entomology must necessarily precede any attempt at research work—I should certainly estimate at least four or five years for a satisfactory course of training. It must be remembered, also, that our knowledge of Indian insects is itself in a comparatively elementary stage. For example, there are no text-books on the morphology, histology, embryology, or physiology of Indian insects, and the materials for such studies are at present scanty.

Another point to which I would draw attention in this connection is that entomology must be considered as a whole and that entomology as applied to agriculture cannot be divorced from entomology in its relations to forestry, medical and veterinary work and general zoology. Any proper course of training in entomology, therefore, should be so arranged as to

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give one general course in this subject for the first two or three years, the students thereafter specialising in the subject as applied in any special direction (agriculture, forestry, etc.).

In any case, it is impossible to obtain satisfactory experts merely by passing students through courses of training regardless of whether they have any real innate aptitude for a subject such as entomology. In biological work it is the man that counts, far more than any training, and unfortunately the supply of really keen entomological workers is practically non-existent in India.

At present also there are practically no openings for Entomologists except in Government service. Therefore, unless men are sent to be trained for posts to which they are intended to be appointed, students have little hope of obtaining posts at the conclusion of their course.

It would seem preferable at present to limit training mainly to students who had been definitely selected for appointments. After training and after a further period of practical work, I should like to see them sent abroad for at least a year to work with a specialist in their particular subject and to broaden their minds.

(viii) Any course of nature study in schools should include a simply written account of a few common Indian insects, showing their life-history, development and connection with man as crop-pests and carriers of disease to men and animals. The chapter on "Insect Life and Insect Pests," which I wrote for Clouston's "Lessons on Indian Agriculture," may perhaps be cited as the sort of thing which I advocate.

It is useless to attempt to teach information regarding insects, birds, etc., unless such information deals with common animals which can be actually shown to the students. Many courses of nature study in India have been framed, I believe, on non-Indian text-books which do not fulfil this requirement.

QUESTION 3.—Please read my note on "Publicity for Entomology in India" (*Report of the Fifth Entomological Meeting, held at Pusa, 1923*, pp. 388-390) and also a paper on "Stored Grain Pests" (*Report of the Third Entomological Meeting held at Pusa, 1919*, Vol. II, pp. 712-761).

QUESTION 4.—I have already suggested means for the better co-ordination of entomological research work in India. (Please see reply under Question 1). The main idea underlying my suggestions is that the acquisition of knowledge regarding Indian insects should be made by a centralised staff of research workers, based on one central Entomological Institute, whilst the application of such knowledge would be made by the provincial or departmental authorities concerned.

Under present conditions, everything possible in the direction of co-ordination is already being done by Pusa as regards the Entomological staff of the Provincial Agricultural Departments, of the Forest Service, of the Zoological Survey, of the Medical and Veterinary Departments and of other entomological workers in and outside of India by—

- (1) personal relations, including loan and exchange of specimens, literature and information generally,
- (2) the publication annually of an abstract of all current literature on Indian insects.
- (3) the Entomological Meetings to which all interested are invited.

Please see my Note on "Co-operation in Indian Entomology" (*Report of the Fifth Entomological Meeting held at Pusa, 1923*, pp. 382-387).

QUESTION 7 (a).—Whilst not suggesting means for reducing loss due to fragmentation of holdings, I should like to point out that control of insect pests is rendered much more difficult when holdings are sub-divided.

QUESTION 13.—(i) The existing measures for the protection of crops from external infection by insect pests are all that can be applied under present conditions of staff, provided that these measures are properly applied.

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There is, however, undoubtedly some leakage of undeclared plant imports into India by passengers who bring in plants in ignorance of the fact that they are thereby contravening the law. The Customs Form which has to be filled in by all passengers prior to arrival at an Indian port does not mention plants at all; this should be amended to ensure that all passengers declare whether they are bringing in any living plants.

I have already drawn attention of Government to the difficulties which will arise when a regular Air Service to India is started.

(ii) I understand this question to refer to the desirability of limiting the spread of insect pests from one district to another within the Indian Empire. Under present conditions, this is outside the range of practical politics.

With a properly enlarged and organised entomological staff, we should be in a better position to commence work on these lines, the first requirement being the collection of information regarding the exact distribution of insects in India. This is, of course, part of our present survey of the insect fauna of India. Detailed inspection of botanical gardens, nurseries, orchards, etc., would doubtless yield considerable interesting facts, at present quite unknown to us, regarding the presence and distribution of insect pests which are so easily sent out to new localities by stock sent from or to such places.

At least one botanical garden in India regularly fumigates all plants sent out, before despatching them, but most of such places are undoubtedly *foci* for distribution of pests, as is soon evident to anyone who will take the trouble to examine living plants despatched by rail from one place to another in India; on examination such plants are almost always found to be infected with one or more scale-insects, *aleyrodids*, etc.

In connection with this subject I would again point out the necessity of dealing with it from the point of view of India as a whole. The entomological staff of a Province may have a good knowledge of the insect pests of that Province but is in a very poor position to know what pests occur outside the provincial boundaries—and it is the pests, that do not occur already in an area, that require to be kept out.

QUESTION 15 (g).—I consider it very desirable that a proper staff should be provided for the prosecution of studies on insect pests of domesticated animals in India. At present comparatively very little has been done in this line and extensive work is required in (i) collecting material and information relative to the occurrence of such pests, (ii) investigating their (a) life-histories, (b) systematics and (c) control, and (iii) ascertaining their connection with animal diseases. This last particularly must of course be done in close collaboration with veterinary workers. I have estimated the annual losses to livestock in India due to insect pests as being upwards of four crores of rupees, so that this branch of entomology is by no means unimportant. I have already projected a book on Veterinary Entomology in India and gathered a good deal of material together with this end in view, but it will still take sometime to complete.

We require, not only general investigations, which will undoubtedly reveal many new pests of which we are completely ignorant at present, but also special research, in direct collaboration with veterinary officers, into the rôle of insects as vectors of diseases such as surra and rinderpest.

Some of the lines of work in veterinary entomology deal with the same groups of insects as are included in medical entomology. It is therefore the more desirable that the insects responsible for carrying human and animal diseases should be dealt with by the entomological staff of a single Entomological Service, to prevent overlapping.

QUESTION 17 (c).—Bee-keeping. The main reason why the demand for honey in India is met at present by supplies to a very inadequate extent is because the methods of extraction and preservation of honey are so defective that good honey can only be obtained in particular districts at certain seasons of the year, when it is freshly collected, and at other times only a thin stale fermented article can be procured. It is a significant fact that, if one inquires for honey in any of the larger towns of India, one is generally offered good honey only of the bottled or tinned variety imported

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from America or Australia. Yet it is certain that the quantity of honey produced every year in India is very large, how large it is quite impossible to say with any exactitude but it probably runs to several scores, if not hundreds, of millions of pounds, as wild honey-bees of one or more species occur in practically all non-desert areas. Besides honey, bees also produce wax, which is collected in large quantities for sale (and, incidentally, is invariably found adulterated when bought in the market), and they also do incalculable benefit by their active share in the pollination of flowers. It is hardly necessary to point out that there is a great demand amongst the peoples of India for honey, which is used both for religious ceremonies and as a valuable food. There seems to be no reason whatever why India should not produce its own supplies of honey to meet all internal requirements and even have a surplus for export, instead of being an importer. This end can be attained by effecting improvements in the methods of keeping the present races of native bees and of extracting and preserving their honey, as well as by judicious crossing of the Indian with exotic bees. To carry out this aim it is necessary to have a whole-time expert in bee-keeping to (1) make a survey of the present methods of bee-keeping in India, (2) select and experiment with the most promising races of Indian bees, (3) supply improved strains of bees to bee-keepers throughout India, (4) show by practical demonstration improved methods of hiving and handling bees and the preparation and preservation of honey and bees-wax, and (5) train selected Indians in such improved practices. We have done some work on these lines at Pusa in the past and have proved that it is possible to increase the yield of honey and to preserve it quite satisfactorily, but with the present staff it is impossible to take our results any further. Pusa also is climatically an unsuitable locality for such experimental work on any large scale.

Fruit growing.—Owing to the permanent nature of such crops, fruit trees are especially liable to the attack of numerous insect pests. Fruit growing is therefore pre-eminently an industry in which entomological assistance is strongly called for if it is to be productive. The subject of fruit flies in India is also an important one.

Sericulture.—This subject was dealt with at great length in the "Report on an inquiry into the Silk Industry in India," by H. Maxwell Lefroy and E. C. Ansorge (Calcutta; Government Press; 1917; 3 volumes), and their main recommendations are summarised at pp. 209-211 of Volume I. With these recommendations I am in general agreement but I would wish to point out that the main requirements of sericulture in India are commercial and not entomological.

Pisciculture.—The importance of insects to fisheries in India was dealt with by Dr. Baini Prashad in a paper which appeared in the Report of the Third Entomological Meeting, Vol. III, pp. 906-909 (1920). No really detailed work has been done on this subject in India but there is no doubt that insects, both as food for fish and as destroyers of young fish, do play an important part which would be well worthy of investigation.

Lac culture.—This is fully dealt with in Pusa Bulletin No. 142 on "The cultivation of Lac in the Plains of India," of which three large editions have been exhausted and a fourth is now in preparation. This subject has now been taken up by the Lac Association, which has a laboratory situated at Ranchi. The main obstacles in the expansion of lac culture seem to be:—

- (1) Fluctuations in market prices. When prices are low, practically no lac is collected, with the result that natural enemies of the lac insects flourish unchecked and the subsequent production of lac is poor in quantity and quality. When prices rise, little lac is obtainable at first and, when efforts are made to cultivate it, which takes time, there is often over-production so that prices fall again to a low level at which it does not pay to produce it.
- (2) The above condition is related to the frequently unfair prices which are paid by the middlemen-buyers to the actual cultivators. Even when prices are high, the actual growers benefit very little and thus have no inducement to production.

- (3) Adulteration of the stick-lac and shellac, which reduces sales in the export market.
- (4) The prevalent practice of collecting the stick-lac before the emergence of the young insects. This practice was adopted of old because the lac was originally valued for its use as a colouring-matter (dye), and for this purpose it was collected before emergence of the young insects, in the same way as cochineal used to be prepared. With the introduction of aniline dyes, the use of lac as a dye has practically gone out, but the old method of collection is still carried on, thereby destroying the major part of the young insects which would otherwise survive to found new colonies. Under modern conditions there is no reason whatever why the stick-lac should not be collected after the young insects have swarmed out, which they do at fairly definite dates.
- (5) Difficulties in obtaining brood-lac when required in any quantity and in many areas, want of the trees on which to propagate it. In this connection, the planting of trees, such as *ber* or *kusumb*, suitable for lac-growing, might be considered in connection with any scheme for tree-planting to prevent erosion.

QUESTION 25 (a).—Please see my reply to Question 1 (a).

So many diseases (*e.g.*, malaria, plague, typhus, *kala-azar*) are carried by insects, that it is very desirable to strengthen the entomological side of any organisation for the investigation or control of such diseases.

Oral Evidence.

A.2115. *The Chairman*: Mr. Fletcher, we have your note of evidence for which we are obliged; do you wish to add any statement of a general character at this stage?—Yes, I should like to say that my evidence is given purely as regards the Entomological Section, the entomological aspect of our work here. As was noted yesterday, the different sections here are practically different research institutes each on their own subject. It is, I think, inevitable that the different sciences connected with agriculture have developed in some cases more than in others, with the result that some of the answers given by Heads of sections are not applicable to all the sections here. I do not say this with any idea of leading the Commission to think that there are differences of opinion between the different sections: I merely wish to point out that questions have been asked to which the replies would have been different had these questions been addressed to other sections.

A.2116. I hope I shall succeed in touching on one or two of the questions of which you are thinking. Will you give the Commission the outstanding points of your own training and any past appointments that you have held?—I was educated at Dulwich College from 1891 to 1895; I was on the science side there. In January 1896 I went into the Royal Navy as an Accountant Officer. From 1896 to 1900 I was out on the China Station. After that I did 3½ years in the Mediterranean; then I was employed in the Indian Ocean for about 6 months, and for 4 years in Ceylon. After that I came to India in 1910 as Supernumerary Entomologist. In January 1911 Mr. Lefroy, who was Imperial Entomologist, went on leave and I officiated for him until April 1912, when I went down to Madras to occupy the newly created post of Government Entomologist. There I organised a new entomological section at Coimbatore; I remained there until December 1913 when I returned to Pusa as Imperial Entomologist, a post which I have held since that date.

A.2117. Is there anything you wish to say as to the suitability or otherwise of the site of Pusa?—I can say that Pusa is a most unsuitable locality from the entomological point of view.

A.2118. Why?—Because the climate is quite unsuitable for the preservation of specimens and also for the rearing of specimens during about half the year. In addition to that, it is not a pleasant climate to live in and therefore you do not get the full amount of work from the staff that you would get under more pleasant conditions.

A.2119. What would you regard as the ideal site for your section?—I have already suggested Coimbatore as a much more suitable locality than Pusa. I do not say it is wholly ideal, but it is the best that I know of.

A.2120. How about the co-ordination of the various sections at Pusa?—It is quite satisfactory so far as I am concerned.

A.2121. Is it an advantage for the purpose of co-ordination and inter-communication that the various sections should be situated together in one place?—I do not think it is essential, because if we had an entomological station in Coimbatore, there is an agricultural centre there, and if any agricultural problem were required to be discussed, there are agricultural officers with whom to discuss it there; incidentally, there is also the Forestry Institute there, so that forest problems could be discussed.

A.2122. How about the touch between you as Imperial Entomologist and the Provinces?—That is very largely, I think, a personal matter; so far I have had no difficulty; I ask them for information and they give it freely; they ask me for information and we give it. If they want to work on a particular group of insects we send them all our material, and if we want material they send it to us. Every month we have to send in here a monthly report of the work done in the section; I send copies of my monthly report to the Government Entomologists in Madras, the United Provinces and the Punjab, and they send me their monthly reports from Madras and the Punjab; so that I keep, as far as I can, in touch with the work which is being done and try to

keep them in touch with the work that is being done. In addition to that, of course there is a good deal of personal correspondence.

A.2123. *Sir Henry Lawrence*: You mentioned three Provinces?—There is no Government Entomologist in Bombay; I only send a copy of my monthly report to Provinces which have a Government Entomologist, not to the Provinces which have only an Assistant. I brought that point up at the last Entomological Meeting, and it is referred to in my remarks in the paper on co-operation; there I suggested tentatively that perhaps we might get in reports from all the Provinces here, reproduce them and circulate them, so as to let everybody know what is going on as far as possible.

A.2124. Would you give the Commission an account of the functions of your office under the present arrangement?—The functions of my office are to deal with all aspects of Indian entomology. The only exception that we make is that we do not deal definitely with forest pests because these are dealt with at Dehra Dun; otherwise we try to take in every aspect of work on Indian insects.

A.2125. Assuming efficient sections under the Provincial Governments, in the various Provinces, would there be any field left for you?—Yes, the field is absolutely unlimited for every Province and for every worker in India at present; we have only touched the fringe of the field. The objection to that would be that, if every Province had its own efficient staff, you would have so many large staffs, which would have to be large to do the work efficiently, that necessarily you would have a tremendous duplication of work being done, institutes, laboratories, libraries, collections, records. It would be a vast expense to the country as a whole and you would necessarily tend to get less co-ordination.

A.2126. Do you travel about the country?—Yes, on the whole I can say I do; I have visited, I think, every Province in India; but of late years I have not travelled as much as I used to.

A.2127. Why?—Partly because the work here is constantly increasing and I cannot get away so much; partly because facilities for touring are not what they used to be.

A.2128. In what way?—Partly in that our travelling allowance has been cut down. In the old days, when I came out here, we used to get double first class when we travelled, and, taking one thing with another, that just about covered expenses. Now, since 1923 I think it was, our rates have been cut down to one and three-fifths and, practically speaking, that does not cover the cost. Another reason is the Devolution Rules.

A.2129. What Devolution Rules do you refer to?—I will just give an example; this is a note which was sent in by Mr. Husain who was officiating for me during my absence on leave last year; he wanted to send out a man from here to obtain information with regard to pests; he sent up a request to the Director here, and this is the reply which he received: "The officiating Imperial Entomologist appears to ignore the administrative problem involved. Under the Government of India and the Devolution Rules central funds are not to be expended on what are really provincial concerns. This point is carefully scrutinised by the Finance Department, and it is the duty of the Agricultural Adviser as controlling officer to assure himself that this condition is fulfilled before he affords sanction for proposed tours and lines of work."

A.2130. Who signed that note?—Dr. Harrison when officiating as Agricultural Adviser. If somebody writes to us to say there is a pest which is attacking his crops, in my opinion the first thing we should be able to do is to send a man straightway to see what is going on, either to be able to advise them on the spot, or, if the man finds he cannot advise them, that he is not competent to advise them, to bring back specimens here and tell us all about it.

A.2131. In the case that you have mentioned, what exactly was the work for which the journey would have been made?—That does not appear on this.

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record and I was not here at the time, but I understand it was one of these cases of a pest appearing and a letter coming in to us asking for advice.

A.2132. It was an emergency?—Yes.

A.2133. *Professor Gangulee*: From what Province?—I think from Bihar.

A.2134. *Sir Henry Lawrence*: In your opinion is it the proper work of the central department to investigate that?—I certainly think it is; I think one of the functions of the central department is to keep as complete a record as possible of outbreaks of pests.

A.2135. You as Head of a branch have no discretion in the matter under this ruling?—No. If I have got to write up and get permission to send a man out, by the time I have done that probably everything is over.

A.2136. *The Chairman*: Are you in touch with research workers in other countries?—Yes, I think we may say we are more in touch with workers in other countries than any other section of this Institute; I have constant requests for information and help from other countries. Quite recently I had a request from Japan for information regarding parasites of a borer in maize. I might mention we have in India, at the present moment, a man from the American Bureau of Entomology collecting material for his own country.

A.2137. Are you satisfied with the existing arrangements to protect India from invasion by harmful insects from overseas?—I have replied to that question in my written evidence.

A.2138. So that you have nothing to add to that?—No. I think the conditions are as good as we can get them under existing circumstances. With a properly organised and large enough staff we should take it over eventually and have a proper entomological section. With the present staff we could not do it.

A.2139. Have you anything to say upon the question of limiting the spread of harmful insects by some control as between Province and Province?—I have nothing to add to what I have already stated.

A.2140. *The Raja of Parlakimedi*: Are any Indians being trained here as Assistants to yourself?—Do you refer to men in the Institute or to the men who are sent for training from outside?

A.2141. No, in the Institute here?—I have at present three Assistants who have been trained; they are all more or less, I should say, still under training.

A.2142. And are they to be sent abroad for training at any stage?—No.

A.2143. That is not the understanding at all?—No. One of my Assistants here was to have gone to America and I tried my best to get him the necessary permission and the grant, but we failed to do so.

A.2144. How long ago was that?—Four or five years ago.

A.2145. That is the only instance you have on record where an application was made to go abroad?—Yes, I think that is so.

A.2146. Would the people who are undergoing training under you here be fit to carry on the duties you are performing here?—I think you rather misunderstood me. The men I referred to are men who have been recently entertained as Assistants in my section.

A.2147. They cannot carry on the work?—They cannot carry on the work at present because they have been here for a very short time.

A.2148. Will they be fit to carry on at any period?—I cannot say; I am not a prophet.

A.2149. For instance, a man in Coimbatore who was Assistant to the Sugar Expert has been carrying on his duties there?—Yes. The present Government Entomologist in Coimbatore was my Assistant when I was there.

A.2150. Has any attempt been made actually to investigate the pests from which *sal* and *teak* suffer?—I do not do that here. That is done at Dehra Dun.

A.2151. Has anything been done to cure the fungus disease from which the mango suffers?—We have not done very much work here because mango

hoppers are not important pests in this district. But a good deal of work has been done in the Punjab, in Mysore and in Madras.

A.2152. So far, I do not think that there is any radical cure for the mango pests, is there?—There is no specific remedy.

A.2153. It has not been touched here?—Not on any scale because, as I say, it is not an important pest here and we have not got the opportunities here for doing it.

A.2154. *Sir James MacKenna*: We hear a great deal about co-ordination of work here at Pusa. Do you not think that collaboration would be a better way of expressing the relationship between the different sections?—I do not think that there is very much in the term; it is the way in which it is done that matters really. What happens is this. If one expert wants certain information outside his sphere, he simply goes direct to the man who can give it and he discusses the matter with him informally. I really do not think that you would want a better system than that.

A.2155. The co-ordination or collaboration, whichever word you prefer, is you think, satisfactory?—Yes.

A.2156. Are you in touch with the entomological work done by the Indian Tea Association at Tocklai?—I receive their publications and sometimes Mr. Andrews comes to our meetings here and I have been to Tocklai as well.

A.2157. Does he consult you with regard to the identification of specimens?—No, because his work is largely on one insect. He himself has admitted that he gets very great assistance from us.

A.2158. What about the Imperial Bureau of Entomology in London?—We only give £500 a year. I recommended that India should contribute £1,000 but the Government would not contribute more than £500. One year they gave nothing; another year they gave £300.

A.2159. Are you of opinion that the Imperial Entomological Bureau is most useful?—Their abstracts of literature, particularly, are valuable to all workers.

A.2160. And therefore Government should continue this contribution?—Yes.

A.2161. *Sir Henry Lawrence*: Where is the Bureau?—In London.

A.2162. *Sir James MacKenna*: What is the position of the Government Entomologists in the Provinces? What Provinces have not got Government Entomologists?—Madras, the Punjab, and the United Provinces have them.

A.2163. What is your view about training in entomological subjects? Do you give short courses here?—We still give courses in lac and we have had various students lately for short courses. At present we have a man under training from the Punjab. But the short courses have been more or less abolished and we have to go up for special sanction to take in men for short courses.

A.2164. Could you give the necessary entomological training here which would qualify an Indian to be a Government Entomologist?—I think that it would be very difficult with the present staff and under present conditions.

A.2165. It would put more work on the Entomologist than he would be able to tackle?—Yes.

A.2166. Supposing an Indian were aspiring to become a Government Entomologist, what course would you recommend for his training?—It depends entirely on the man himself, as to what he knew already.

A.2167. What generally do you think, from your knowledge and experience, would be the type of man that you would like to get for such training? What sort of a training do you think would be most suitable as a set-off before he came to you for a specialised training in entomology?—I think that it would be an advantage if he had already had some experience in the Provinces before he came to us.

A.2168. For instance, take a course in biology. Do you prefer to get a man who has done a certain amount of spade work in the college?—What I

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meant was a man who had done work as an Entomological Assistant in the Province and not necessarily one who has been through the agricultural course. It depends entirely on the man himself.

A.2169. *Professor Gangulee*: From the point of view of equipment and from the collection of tropical insects that you have here in this Institute, do you not think that this Institute is one of the best in Asia?—Yes, I think so.

A.2170. Do you think that if you could develop this Institute you could attract students from various parts of Asia?—No doubt; you would certainly attract them. The bigger the place the more people you would attract and the better would the work be.

A.2171. You have shown us this morning the vast area that you are called upon to command, that is from the Malay States to Peshawar. In view of this vast area that you are able to command, is it not necessary to extend this department so as to meet that demand?—I have already put forward my views on expansion of entomology in India in my written evidence.

A.2172. Do you think that having made a good beginning it ought to be extended to meet that demand? Is that your considered opinion?—The demand for what? For training?

A.2173. For training, or to get information, and for entomological work generally?—I think, in view of the importance of entomology to India, it certainly should be expanded.

A.2174. You would not confine it merely to serve the needs of the Indian Agricultural Service or meet the needs of the Provinces? Would you look upon the problem from a wider point of view?—Yes, from the point of view of the country as a whole.

A.2175. And adjoining countries also?—We should have to collect information, as far as possible, from adjoining countries, but of course we could not expect to control them.

A.2176. Not for controlling insect pests so much as for educational purposes. Supposing students wanted to come from South Africa, would you take them?—Why not?

A.2177. You could take them?—Certainly, if they wanted to come.

I was thinking of the problem from the Empire point of view.

A.2178. With regard to the unsuitability of Pusa, you have stated that there are two difficulties, first with regard to the preservation of insects and second the rearing of insects, and you suggest that Coimbatore would be a suitable place. In what way, do you think, Coimbatore would be suitable?—It has a much more equable climate, and you can carry on rearing work practically all through the year.

A.2179. It is merely the climatic condition?—Yes.

A.2180. With regard to the rearing of insects, could you not reproduce the optimum conditions in your insectary? If you had a properly equipped insectary built, could you not obviate the difficulty about climate?—It would be very difficult to do that; it would be rearing things under unnatural conditions.

A.2181. In carrying out experiments here, do you collaborate with other departments?—When necessary, yes.

A.2182. You have to carry on some plot experiments, or field trials?—Sometimes. If I want to grow cotton on the farm, it is necessary to go to the agriculturist, to get a plot of ground, and perhaps get it planted. We used to do that when we reared parasites. We used to keep our cotton plants on the farm and let the boll-worm run riot on the plants, the parasite breeding on the boll-worm. We collected parasites and sent them up to the Punjab.

A.2183. What is the exact procedure of your following up the life-history of pests? You first discover the pest, for instance, and study the life-history in an insectary and then you reproduce the conditions in the field; is that the process?—More or less it is so; but discovery is a thing which perhaps takes years. We have been able to rear last year a caterpillar which we have

known for 16 years, almost ever since I came to Pusa; we have found it very, very difficult to get it out, and it is only last year that we succeeded in doing so.

A.2184. As a result of 20 years' work, do you think you have now a survey of the insect pests which infest the major part of India?—We have a rough idea about it.

A.2185. Have you any idea as to the distribution of the pests?—We have the beginnings of information; I should like to say that we certainly have not got complete information.

A.2186. Do you think it would be useful to have a survey of that sort properly made?—I think it would be most useful; we have been trying to do it all the time.

A.2187. Perhaps you are not able to do it because you have not got adequate staff?—We certainly could do much better if we had a larger staff.

A.2188. Would you agree that that sort of survey could be undertaken in collaboration with the provincial departments?—We do undertake it in collaboration; we ask them to give us information. It is one of the objects of these Entomological Meetings that are held here, to get information and interchange of ideas, not merely between the Provinces and ourselves, but between the different workers in different Provinces.

A.2189. You have adequate information to put it together with a view to formulating a general idea of the distribution of the insect pests throughout the country?—We have a rough idea of it; I published a list of insect pests years ago.

A.2190. Merely from the point of view of distribution?—Distribution in space and also food plants.

A.2191. Are you trying to correlate distribution and incidence of insect pests with climatic and other factors?—That is a question of collecting data over a sufficient length of time for every insect. I hope, in future, entomological work will largely enable us to predict the outbreak of pests when we have got sufficient information. We might be able to say, for instance, that next year there will be a particular insect pest in Bombay, and we can take measures in advance. That means a good deal of work; it cannot come in our time; we can only lay the foundation.

A.2192. You have laid the foundation, and the next step ought to be that?—Yes, I quite agree.

A.2193. Would you tell the Commission any definite results obtained with regard to the control of insect pests, results which would enable you to go confidently to the cultivator and say "Do this and you will solve the problem"?—Such measures as control of grasshoppers by ploughing, and general agricultural methods like clean cultivation.

A.2194. Clean cultivation, spraying, and so on, are, of course, the ordinary platitudes of entomological control method. I want to know whether you have got something definite with regard to any insect pest in this country which will enable you to say "We know the life-history of this pest, and this is the method of control"?—For *Agrotis ypsilon* at Mokameh we used Andres Maire traps, and we found we could control it by that means.

A.2195. And you transmit that method to the provincial departments concerned?—Yes, that work was done in direct collaboration with the provincial department.

A.2196. *Mr. Calvert*: Have you done anything for the cotton boll-worm?—We have done a good deal on boll-worm and our information has been published.

A.2197. *Professor Gangulee*: Have you developed any new method of tackling the problem of the boll-worm?—Nothing new; Mr. Richards of the United Provinces is on the work at present.

A.2198. In my experience in Bengal villages, I found that the cultivators lose a great deal of their stored grains through weevils and insects. Have

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you done any experiments with regard to those insects?—I gave the Commission a copy of our bulletin on stored grain experiments.

A.2199. I have noticed that. But have you studied those weevils in detail here?—All that information is in the bulletin.

A.2200. Have you used any gaseous insecticide to control weevils?—No, that is not practicable on a village scale, under the conditions of an ordinary household.

A.2201. It is a practical proposition, perhaps, where large storage is concerned?—It is, for large storage perhaps; we have not taken that up so far.

A.2202. When you find a method of control here, do you ask the provincial departments to test that method? Supposing you are studying certain insect pests here and you find out the way in which they can be controlled, do you ask the provincial departments to repeat your experiments?—We do not ask them to repeat them; obviously, if we have found out a successful method, they will copy it; we do not need to ask them to do it, when they are quite willing to take up any methods which are successful.

A.2203. One has sometimes to suggest such trials and investigations; it may not occur to them at all?—We do not keep it secret; we let them know what it is.

A.2204. On the question of your relationship with the Veterinary Department, you have a department here, I understand, where you study insects responsible for carrying diseases?—It is not a special department.

A.2205. You do not study pathological entomology?—Yes, we go as far as we can.

A.2206. Are you in touch with the Imperial Veterinary Department?—Yes, I am.

A.2207. Is any work being done on collaboration with that department?—I am at present preparing a book on Veterinary Entomology for India.

A.2208. I understand lac-culture is a very important industry in this Province. Is any work being done with regard to that?—I should say a very large amount of work has been done on lac: we have issued a bulletin on lac-culture, for which there is a great demand at present; it has run through 4 editions. But with the starting of the new Lac Institute at Ranchi, it seems rather unnecessary to duplicate the work.

A.2209. You are in touch with the Institute at Ranchi?—Yes.

A.2210. Do you hold out any prospect for apiculture in this part of the country?—I think there is a very big outlook for apiculture, provided we get the staff to work it.

A.2211. How many students have you in your department for training?—There is one at present, and there is another coming from the United Provinces for systematic entomological training; we have had an application a few days ago asking if he could be sent over.

A.2212. How many more students could you accommodate in your section?—For how long a period?

A.2213. For 2 years?—I should think we could take 4, or perhaps half a dozen.

A.2214. Have you any students from the Universities of this country, wishing to take up entomology from a scientific or economic point of view?—We have had several men who came here for a short period, for a month or so, or perhaps longer.

A.2215. Do you think that method of the short course has stimulated interest?—I hope so.

A.2216. Are you in touch with the students who come here? Do you follow up your relationship? Supposing I come to you to be trained for a couple of months, would you have my address and send out entomological literature to me and so on? Do you have that sort of relationship established between the students and yourself?—I think it depends entirely on the

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student; if he likes to write to me and keep in touch with me, he can do so, but if he drifts away, he drifts away.

A.2217. You have said that there is no adequate interest taken in entomology; I take it it is the function of the Institute to create that interest?—We try to, but it is difficult to keep a large number of irons hot at the same time.

A.2218. *Mr. Calvert*: You ventured upon an estimate of the losses to India from insect pests. Have you any reason to believe that the percentage of loss in India is higher than in other countries?—I should not think it is higher than in other countries in the tropics, but it is certainly higher than in temperate countries.

A.2219. Higher than in European countries?—I should think so.

A.2220. The extra large staffs in European countries which you were mentioning this morning are not due to the fact that the loss from insects is greater, but to the greater interest in the subject?—I think that is so, on the whole.

A.2221. *Mr. Kamat*: You told us that the interest in entomology was not adequate in this country. Is that indifference general, or specific, and only confined to Indians?—Comparison is proverbially rather odious, but you must realise that a man who is really keen on insects is rather a rarity in all countries. Even in European countries, only a very small percentage of the population is really keen on insects, but you do get there a much larger proportion than you get in most Asiatic countries, except perhaps Japan, where there have been several men who are really keen on insects.

A.2222. I do not want to dispute the fact that the general interest taken by the Indian public is very small. But I want to go further and find out from you whether there are not other reasons for it. You sent up your proposal for an Entomological Bureau to the Government of India, and you also made an appeal to their hearts and imagination that the loss from insects to the crops of India was something like Rs. 200 crores, which is perhaps as big as the revenue of the Government of India; and yet they turned down your proposals. That shows that even the Government of India are rather indifferent to your science?—I quite agree with you.

A.2223. If the Government of India are so indifferent, we need not blame the Indian public?—I do not blame them a bit; I merely want to stimulate their interest and curiosity and so on in the science; and if I can stimulate the imagination of Government by appealing to their pockets, that is one way of doing it.

A.2224. May I further ask you whether you have found that the interest taken in insect life, as a hobby, by the Europeans in this country is any stronger than that taken by the Indians? Do you think that is a noticeable feature?—I think it is; on the whole, I regret to say it is so.

A.2225. They show a stronger interest?—I find more Europeans writing to me, wanting information about insects; they find something that appeals to them.

A.2226. *Professor Gangulee*: Europeans in their unofficial capacity?—They are mostly unofficial people, planters and all sorts of people; the Europeans write to me, and occasionally an Indian may do so, but not often.

A.2227. And therefore public opinion amongst the Indians to treat insect life as a hobby has to be stimulated by some method?—I think it does require stimulation. My book on "South Indian Insects" was printed in a fairly large edition for a book of that character, but all the copies were sold out. I cannot say how many copies were bought by Indians and how many by Europeans. But as the whole edition was sold out there must have been a certain amount of demand for it.

A.2228. *Dr. Hyder*: Did you ask somebody to have that book translated into some of the vernaculars in India? You know about 80 per cent of our people cannot read and the remaining have a purely literary education. You cannot expect them to have an interest in insects?—That book was published

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by the Government Press, Madras, and if any one wanted to bring out a translation I dare say they could get permission.

A.2229. Do you not think it is your business to stimulate that interest?—I am afraid I could not undertake translation.

A.2230. *Professor Gangulee*: How many copies were printed?—1,500.

A.2231. And sold in how many years?—They were sold out some years ago; within about ten years.

A.2232. *Mr. Kamat*: Considering the vast importance of entomology to the country and to agriculture, it is important that you should take steps to achieve publicity. What steps are being taken here at Pusa to give as much publicity as possible to this question?—We cannot do very much here. We hold these meetings.

A.2233. Do you take steps to send some of your results to the public press, or do you ask them to review or to bring to the notice of the lay public, any facts about entomology?—I do not send them; they receive copies of our publications.

A.2234. But then we know generally what it is in this country. Unless special attention is drawn to these matters the lay public is not likely to go into these indirect technical questions. I want to know whether you ask the Director of Information or the Government to arrange for a wider publicity of your results?—We have not asked the Director of Information particularly.

A.2235. You agree that it is necessary?—I agree. I have often said that a publication department should be attached here.

A.2236. If your results are to be of any value to the general public and much more so to the cultivator, you agree that it is essential for you to maintain here a sort of publicity department, or ask the Government to arrange better publicity than you are having now?—I have already suggested a publicity section in my scheme for an Entomological Service.

A.2237. Either through the Pusa Institute or through any other Government department, so that the whole country might come to know of the results arrived at here? What steps are being taken for a wider publicity?—I have not taken any special steps except that these papers are published and all Government departments and agricultural stations and so on get copies of our publications.

A.2238. You said something about the difficulty in the matter of touring expenses, a difficulty raised by the Finance Department. We all agree that there ought to be greater co-ordination. But I should like to know from you what it is exactly that you want the Finance Department to do. Is it that the Director should have some discretionary grants? What actual remedy would you suggest to counteract the effect of the present restrictions of the Finance Department or the Audit Department?—I think we should go back to the old system that we had when I came here.

A.2239. You mean, to allow you to spend on touring to an unlimited extent?—When I came here first Sir Robert Carlyle came down here and he told us that Government wanted us to tour in the Provinces as much as possible to make ourselves acquainted with local conditions. He said, 'Do not hesitate to tour; it does not matter about your travelling allowance.' Now the position is absolutely the reverse. We are not wanted by the different Provinces. We must not go there unless we are asked to go and when we do go there we find that we are out of pocket.

A.2240. That means you want a sort of *carte blanche*?—That was what we had in the old days and I do not think it was found there was any unnecessary expenditure.

A.2241. As the old days have gone now, I want you to suggest a better method of securing some latitude and I want to ask you who should be given discretion to determine whether an officer should go to the Province to co-ordinate the work or whether the provincial officers should come up here, the Director or the Ministers in the Provinces? And should they be allowed to spend money on travelling allowance to an unlimited extent or should there

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be any limit placed by the Audit Department? Have you got any definite suggestion to make?—I think it should be largely left to the discretion of the Head of the section here as far as the touring of that section is concerned.

A.2242. That is, if the Director here thinks that a visit by you, say to Bombay, is absolutely necessary, his word should be final and the Finance Department should have nothing to say?—I do not think the Finance Department would object if the Director personally considered that the tour was absolutely necessary.

A.2243. I should like to ask you about the conditions of service of your Assistants and how they are recruited?—That is one of our difficulties at present. The grade of Assistants here starts at Rs. 100 a month and rises slowly by increments of Rs. 10 a year up to a maximum of Rs. 300. Under modern conditions you can get the men, even some M.Sc.'s, on the money; but either they are not good men or they are men who come here because they cannot get a better job elsewhere, or else they are good men who just come here for the benefit of cheap training as Assistants and then go off somewhere else afterwards. We have great difficulty in attracting good men and keeping good men under those terms.

A.2244. You emphasise therefore that the starting salary for your Assistants, and their prospects ought to be improved if your work is to develop properly?—Yes; I consider it essential.

A.2245. *Sir Henry Lawrence*: You have suggested that your work should be transferred to Coimbatore. I understand that you wish to have your work cut off from other branches and have a separate Entomological Institute?—Yes, to do not only agricultural work but also all other entomological work.

A.2246. You think there will be no inconvenience from being in a different site to the other branches of agricultural research?—No, I think the advantages of transfer would outweigh any disadvantages.

A.2247. Your selection of Coimbatore is not final? You have lived there?—That was all discussed a great deal. Coimbatore is not an ideal place but it is the best place I know of.

A.2248. What are the primary conditions that you would desire for a successful institute?—I want a place where you can rear insects all the year round, a place with a good climate and also suitable for preservation of collections.

A.2249. Those are the three essential conditions?—Yes.

A.2250. You should be comfortable?—I mean, if you live in a decent climate you can get better work done.

A.2251. And your specimens should be preserved?—Yes.

A.2252. What about the accessibility to other parts of India?—In a great country like this that does not matter so very much and such a thing will, in the near future, be solved by aerial transport.

A.2253. So that you do not think that you should be within easy reach of one of the great sea-ports, say Bombay or Calcutta?—Coimbatore is within quite easy reach of Madras which is one of the sea-ports, and also of Tuticorin.

A.2254. Are you in touch with the college recently established in Trinidad?—No; we are not in special touch.

A.2255. Are the insect pests there of a similar character to what you have here?—I think that they are practically all different.

A.2256. So that the title, 'College of Tropical Agriculture,' does not refer to India?—It would not cover most of our pests. Theirs are different from ours.

A.2257. Have you any knowledge as to the size of the entomological staff there?—I have not any first-hand information; I know there is an entomologist.

A.2258. Have you not got the particulars in your records here? Could you not get them for us?—No, I do not think we have any information here.

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A.2259. Have they not published any works?—I have not got anything myself; there may be something in the library.

A.2260. What is the total budget of your section?—Roughly, about Rs. 75,000.

A.2261. In the scheme you put in in 1920, you asked for a budget of Rs. 7 lakhs?—About that amount. You must remember, however, that that scheme includes all entomological work, whereas my budget here only includes Pusa, and not the other 12 entomologists who are working in different parts of India at present.

A.2262. Rs. 7 lakhs would be sufficient, in your opinion, for the entomological work of all India?—That is my budget estimate.

A.2263. What do you mean by that?—I am not a financial expert; I have only worked out the figures roughly, but that is about the amount it would cost.

A.2264. You show on that budget 29 experts at Rs. 1,000?—That is a sort of average pay. Some would be drawing more and some less.

A.2265. Is that on the assumption that the staff will be European or Indian or both? What was your plan?—I took it that that would be an all-round figure for a general average.

A.2266. With a mixed staff?—Yes.

A.2267. But you would not be able to recruit for a cadre of that character in India for some considerable time to come?—I calculate it would take 10 years to work up to a staff of that size.

A.2268. You were asked just now whether you could point to any definite results of your work. Can you point out anything which you have shown which would have saved expenditure on the part of the Government if it had been known earlier? If any of your results had been known earlier, would they have prevented the waste or unnecessary expenditure of public money? To take an example, I was under the impression that in Madras the flea of the rat had been shown to be of a different variety to the flea which carries plague. Is that correct?—Yes. The fleas in Madras are *astia*, whereas the ordinary rat flea is *cheopis*. The latter carries the bacillus of plague; the former hardly carries it at all. I thought you were referring to things done here; we did not discover that fact here.

A.2269. Whom was that discovered by?—The flea was described by Rothschild, I think.

A.2270. That is the kind of information which could prevent the waste of public money?—Yes. A lot of trouble was taken at the time to prevent Madras being infected with the plague.

A.2271. There was very heavy expenditure on the destruction of rats, which was wasted, for this reason?—I think the destruction of rats is always advisable; you save money by avoiding the damage they do.

A.2272. That is a totally different question?—I have not any first-hand information as to the amount of money spent to keep plague out of Madras, but I know there was a tremendous number of regulations in force.

A.2273. I am trying to get from you, by means of an illustration, what the advantage of systematic entomology is. This is an illustration?—Yes, this is a case which proves the value of systematic entomology. There is a very minute difference between the two fleas, but the fact that there is this distinction makes all the difference with regard to the carrying of plague.

A.2274. From that would you infer there are other cases where other insects have been attacked owing to lack of accurate, systematic entomological information?—There have been such cases, undoubtedly.

I want you to give us something definite on which you can recommend this expenditure of Rs. 7 lakhs a year which you have asked for. If you can give us some illustrations it may help the case.

A.2275. *The Chairman*: You can put them in later, if you like?—I think it would be better: I may have to criticise other people's work in some cases.

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A.2276. *Sir Henry Lawrence*: You will put them in later?—Yes.

A.2277. *Sir Thomas Middleton*: Continuing the subject *Sir Henry Lawrence* has raised, you estimate the losses incurred in India through damage done by insects at roughly Rs. 200 crores. You agree, of course, that even with the most perfect Entomological Service in the world it would be impossible to prevent more than a fraction of that loss?—Yes.

A.2278. But there must be a very considerable fraction which is preventable?—Yes.

A.2279. Recognition of that fact has led, in recent years, to the extensive development of the control of insect pests in the United States and Great Britain?—Yes.

A.2280. It is unlikely those countries would have gone to that expenditure unless they found it profitable?—I think there is no doubt they have found it profitable. They have realised the importance of it and increased their staffs accordingly.

A.2281. You contrasted, in reply to some previous questions, conditions in Europe with conditions in this country. Do you agree that amongst scientific workers in Europe the entomologist is particularly fortunate in having a larger number of voluntary workers to assist him than is the case with many other sciences?—That is so to a large extent because economic entomology is a comparatively modern science. The real science of entomology has been built up in the past purely by voluntary workers, and there is still a very large proportion of voluntary workers.

A.2282. That voluntary work begins in most English schools; in most English schools you will find butterfly nets and so on?—Yes.

A.2283. It begins with the boys and is continued?—Yes, in some cases, but not always; some people take it up in later life.

A.2284. The case of the Madras flea has been mentioned. Rothschild was a voluntary worker of some note, I think?—Yes.

A.2285. You have pointed out that a similar interest does not exist among the general public of this country, and therefore you indicate one must rely to a greater extent on official assistance. I think that is your argument?—That is so, generally speaking.

A.2286. How many official entomologists have you at work in India?—About 13 at present.

A.2287. Would you care to give any indication of the number you would like to see at work?—There is practically no limit to the amount of work.

A.2288. What is the scope in India?—The scope is absolutely unlimited, at any rate in our generation.

A.2289. If the scope is unlimited, we must begin with the training of suitable persons. How would you proceed to train them? You have indicated that 2 years at Pusa are useless for the type of student that is sent to you?—That is so, because the type of student who is sent to us has no knowledge whatever of the subject when he comes.

A.2290. What is the knowledge you desire him to have when he comes?—If he is really keen on insects I do not want much more to start with, but you cannot turn him out in 2 years even if he is keen.

* Two instances may be given to show the value of systematic work and the necessity for this to precede applied work in Entomology.

In the first instance, the various borers in sugarcane, maize, *guar*, rice and other cereals were lumped together under the name of "moth borer" (*Chilo simplex*) and recommendations were made for the growing of maize as a trap-crop for borers in sugarcane. Subsequent investigation has shown, not only that the borers in sugarcane, maize, etc., are quite different, including over a dozen species with distinct habits and food-preferences, so that no one method can possibly control them all.

A second instance may be found in my *Report of the Second Entomological Meeting, Pusa*, pp. 196-197.

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A.2291. If you want a good educational basis, what should you have? What is the normal training for an entomologist? Is it not a degree with zoology as the main subject?—Yes, nowadays that is about it.

A.2292. As you know, we have in Britain in the past 10 or 15 years been training entomologists, and we select for training persons who have taken an honours degree in zoology?—Yes.

A.2293. Can you not get men of that type to train in Pusa, men who have taken a science degree in zoology in an Indian University?—As I said just now, the only student who has done his 2 years' post-graduate course here was an M.Sc. in zoology, and he came here knowing nothing about entomology at all.

A.2294. *Sir Henry Lawrence*: What pay did you give him when he was here?—None. He had to pay Rs. 25 a month for his training.

A.2295. *Sir Thomas Middleton*: You referred to the question of salaries, and some emphasis was laid on the amount of the starting salary. Do you not think that in a subject of this sort prospects are more important than the starting salary?—I think the present starting salary is too low and the rate of increment is too slow.

A.2296. You indicate that entomology covers not only agriculture proper but forestry, veterinary and medical questions. Is there any real objection to the separation of the forest work and your work here in Pusa? Is not there work enough for both of you?—There is plenty; the only point is the avoidance of unnecessary duplication.

A.2297. Is there unnecessary duplication?—I think there is. Government has the expense, for instance, of keeping up two big libraries on entomology.

A.2298. Are there any other objections?—There is the keeping up of two collections. Very often the insects they deal with there are the same as are being dealt with here.

A.2299. I do not quite follow the reasons which lead you to select Coimbatore as against Pusa? If you compare Pusa with the places in which European entomologists work, you are in a much better position?—I would ask you to come here in 6 months' time and ask you if you would like then to put it in that way.

A.2300. I am not talking of you but of your insects; in 6 months' time the conditions are very favourable for your insects?—I do not think we are much better off here; insect activities practically close down in October till about the end of February; then we get a short outburst of activity about the beginning of March and after that they close down again until the advent of the monsoon.

A.2301. There is no lack of activity in the monsoon?—No. Then of course in the monsoon you get intensely damp conditions and when rearing insects, their food often goes mouldy.

A.2302. Comparing your conditions with other entomological conditions, I cannot think that the locality imposes very severe restrictions upon you. Have you worked in laboratories in Britain?—Yes, I was working there last winter for 6 months.

A.2303. Your conditions so far as the study of living insects is concerned must be better here than they are there?—Perhaps, but they are not the best we can get in India.

Yes, it may be that they are not the best conditions but they are good.

A.2304. *Dr. Hyder*: You require a regular Entomological Service after the approved models of other services, such as the Police, Agriculture, and so on?—I think the Geological Service is more the type one might keep in mind.

A.2305. Have other countries got such a regular service?—Yes.

A.2306. Are you aware of other countries that have definite conditions as to personnel, pay, promotion and pension?—The United States, of course, is the best example.

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A.2307. Has England got such a service?—It has, on a very small scale as compared with other countries.

A.2308. With regard to this loss of 200 crores, do you claim accuracy for your figures?—I claim they are as sufficiently accurate as I could make them.

A.2309. One could not add another 200 crores to it?—No, I went carefully into the outturn of crops, the areas under crops, and we took the valuations as far as we could from the market prices and so we got a rough idea of the value of all the crops grown in India, and then we took the losses on each crop.

A.2310. You speak of dissatisfaction prevailing among entomological workers; does that dissatisfaction extend to both higher and lower grades?—I do not think we are too satisfied with conditions.

A.2311. Conditions of pay and prospects?—Yes.

A.2312. What is the difficulty with regard to obtaining rare books?—Very few copies of the older books come into the market; there were very few copies originally and most of them have now gone into public libraries, so that it is very rarely that a copy is obtainable. When such a book is offered by a bookseller, under the Budget Rules I may or may not have money at the time. You cannot foresee when one of these books that we want will be available; when it is available, if we have no money we cannot get it, and by the time the money is made available the book may be unobtainable. What we want is to have a definite sum that we can lay our hands on at once and buy straight away without any red tape.

A.2313. Are you not given a definite grant for the purchase of books?—Yes, but it lapses; what I want is a definite sum that will not lapse.

A.2314. With regard to this difficulty as to conducting examinations, why should you not visit the agricultural colleges and sit on their committees dealing with courses and examinations?—Because if I go to attend an examination, nowadays the Province in which the examination is held has to pay my expenses, and they will not do that; they will not ask people in from outside if they have got to pay their expenses.

A.2315. Do your remarks apply to Indian Universities as well as to the Government Agricultural Colleges?—The Agricultural Colleges; I have had no experience of examining for the Universities.

A.2316. The Agricultural Colleges will not pay your travelling allowance; they are far behind in this matter as compared with the Indian Universities. For instance, an Indian professor stationed at Peshawar will do examining work at Calcutta?—In the old days I used to go down particularly to the Central Provinces and Madras; every year they asked me to go down and do their examinations. It meant that I kept in touch with the teaching work there; it also gave me an opportunity of going round and seeing what they were doing, giving any advice or information and getting information myself; I think it was of mutual benefit to all concerned.

A.2317. With regard to your suggestion as to giving a short course of lectures at these provincial agricultural colleges where entomology is a subject of study, do you think you could do much in a year? I do not think your idea is to hold the course for a full academic year?—No, I think you have altogether misread what I say. What I suggested was that if we had a properly organised service, it would be the duty of one member of the staff to go round to these various colleges and give short courses, not for a year but for about a month at the outside at each college. That would not replace the present courses but would supplement them. The provincial agricultural colleges would carry on their training courses, which you must remember are for agricultural students and not for entomological students. They get a smattering of entomology, but in addition to that the Central Institute would send out a special lecturer; he would have all the latest information about all pests, he would have specimens, diagrams, films, and everything of that sort. You could get it very much better done if you had one man going out from a central place, and he would give the students a separate extra course to supplement the local information which they will have derived from their own staff.

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A.2318. Are you familiar with the courses of study at these provincial agricultural colleges? Does entomology form a subject of study at all these colleges?—A certain amount of it, yes; I was two years at Coimbatore.

A.2319. It is taught in the first two years, is not it, at all these provincial colleges?—I would not like to say it is taught in the first two years at all of them, because the courses vary from one college to another; but generally speaking they get a certain amount of entomological instruction during their agricultural course.

A.2320. Would you like entomology to be a subject of study at these provincial agricultural colleges?—It is already; they give a course of training in entomology in their course of agriculture.

A.2321. I thought you said entomology did not figure as a subject of study at these provincial agricultural colleges?—No, you have misunderstood me; I did not say so at all; it is part of the training.

A.2322. Now with regard to this matter of the education of the ryot, who is, after all, the chief man, apart from the service and the collection of books and other matters, what measures would you suggest?—That I think is a matter purely for the local department; it is for the local department to do that local demonstration and propaganda work.

A.2323. Let us go through this matter step by step. You think it would be a good thing to have a readable primer on common Indian insects, in the vernaculars of the different Provinces, for the education of children?—I think a primer on insects would be rather too much of a mouthful for them all at once, but if you had a few facts about insects in their ordinary reading book, that would be a good thing.

A.2324. If you do not agree with that, what would you suggest for the education of the adult ryot who cannot read or write but who knows he incurs losses on the crops he grows?—As I have said, that is a matter for the local departments, but, generally speaking, they should be able to send demonstrators round to the ryots to explain these things to them, as they cannot read or write. That is being done.

A.2325. *Professor Gangulee*: Would you like to see entomology a subject taught in the Universities of this country; would it help your work very much?—Yes, we have already passed a resolution to that effect at the last meeting.

A.2326. Do you consider it a very essential step towards obtaining suitable recruits to your department?—I say we have already passed a resolution to that effect, but, like most resolutions, it has not gone any further.

A.2327. With regard to the point raised by Sir Henry Lawrence as to the saving that may result from entomological investigations, is any work being done to prevent damage being caused by insects to railway sleepers, Army stores or grains in elevators?—We carried out some experiments here on the treatment of wood against termite and those results were published; considerable work has been done at Dehra Dun by the Forest Economist on that subject.

A.2328. Was that work drawn to the attention of the Railway Board?—It was done at the direct request of the railway people.

A.2329. Would there be a considerable saving if your method of controlling termites could be adopted?—As I say, we did some work here and our results corroborated those arrived at at Dehra Dun.

A.2330. With regard to popularising entomology, have you at any time received requests from the Department of Education in this country to utilise all your beautiful charts, graphs, coloured plates and so on?—We have had a large demand at various times from different schools; I could not give you the list of them off-hand.

A.2331. The demand is there?—Occasionally.

A.2332. Have you thought out the problem of utilising the cinema for popularising the study of the insect life cycle?—We have thought of it.

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A.2333. But nothing has been done in that direction?—No.

A.2334. You think the cinema would be a suitable medium through which the subject of insect life could be made popular?—Yes, I certainly think it could; I suggested that in my note on publicity of which you have a copy.

A.2335. Do you find the administrative duties of your section hamper you in any way in your research work?—They take up most of my time.

A.2336. *Sir James MacKenna*: Do you anticipate any difficulty in reviving the Sectional Meetings in entomology?—No, I do not anticipate any difficulty. We should have had a meeting two years ago; it was arranged. I wrote around the Provinces and told them we were going to have a meeting and one or two papers were sent in; then I was ill and was unable to hold it.

A.2337. I ask the question because we have been told that the Devolution Rules and travelling allowance troubles have rather tended to wreck that scheme?—Those rules have rather arisen since we had a meeting; I cannot say what the effect would be on the next one, but I hope to continue them; I do not see any reason why they should not continue.

A.2338. The Government of India have not given an expression of opinion in the sense of discontinuing them on account of expense or anything of that kind; they have not been involved in the retrenchment policy?—No.

A.2339. Of course you consider them to be extremely important; I know you started the idea in Pusa?—Yes, I consider them to be very useful; at the last meeting there was a resolution passed to the effect that they should be continued.

A.2340. Biennially or triennially?—Biennially.

(The witness withdrew.)

**Dr. W. H. HARRISON, D.Sc., Imperial Agricultural Chemist, and
Joint Director, Agricultural Research Institute, Pusa.**

Replies to the Questionnaire.

QUESTIONS 1 AND 4.—Questions 1 and 4 relating to research and administration are so closely inter-related that it is difficult to deal with them individually. The factors which have to be considered in formulating suggestions relating to the administration and co-ordination of the agricultural activities of the Governments in India are the same which have operated to bring about the present situation in regard to the organisation of research, and they bear equally upon any suggestions for the advancement of the latter. A review of the factors which have so far guided the course of events seems therefore to be a necessary preliminary to the formulation of proposals for future improvement.

Taking first the organisation of the Departments of Agriculture in India, it may be noted that previous to the year 1904, an Indian Department of Agriculture was practically non-existent. That year marked the inception of a scheme from which agricultural development in the All-India sense originated. Agricultural Departments staffed by the I. A. S. officers specially recruited for the purpose, were developed in each Province and a central department was created directly under the Government of India, the underlying idea being that whilst the provincial departments would be concerned mainly with the study and development of local agricultural conditions, the central department would take a more general view of agricultural problems and act as a co-ordinating and advisory body. This latter function was strengthened by the establishment of a Board of Agriculture for India to meet annually with the object of giving the experts an opportunity of exchanging ideas with one another, of learning what is being done in the various Provinces, of co-ordinating their work and advising on agricultural administration generally.

The central department was staffed by senior officers who possessed considerable experience of Indian or tropical agriculture, whereas the provincial departments were staffed mainly by junior men possessing little or no knowledge of tropical agriculture, and often recruited direct from the Universities. As a consequence, in those early days, the central department readily fulfilled the functions laid down and formed a real centre for the activities of whole department.

The provincial departments were staffed with Agriculturists, Chemists and Botanists, who were in most cases supplied with full facilities for carrying out their duties, and experience rapidly accumulated. This experience being mainly local in character was not shared by the officers of the central department, and thus the first intimate relations between the two branches tended to lessen as time went on. With the growth of the department, the Board soon became unwieldy and it was no longer possible to collect all the members of the Agricultural Departments together for the meetings and, in 1908, the membership had to be reduced with the result that the scientific experts in particular rarely came into intimate contact with their colleagues in other Provinces. Later on the meetings were held biennially instead of annually and discussions of the programmes of work of the various departments were dropped. None the less the co-ordinating influence of the central department still persisted in an effective but voluntary form.

With the inception in 1919 of a scheme of general expansion, which aimed at making the expert staff of each Province complete in itself and capable of dealing with all local problems of immediate importance, the provincial departments developed a tendency to adjust themselves into independent units and this movement received an impetus through the introduction of the Devolution Rules, 1920, framed under the Government of India Act, and the classification of Agriculture as a Transferred subject in the Provinces.

As a sequence to the decision to treat Agriculture as a Provincial subject in charge of Ministries, the central department could no longer exercise the same influence over the development in the Provinces as hitherto, and discussion of matters relating to agricultural administration in the Board of Agriculture necessarily became restricted. The waning influence of the central department suffered a further check through the concessions made by the Lee Commission, especially—(1) The introduction of selection grade posts into the department removed the financial attractions which had led to recruitment to the central department from the most capable of the provincial officers, and further when these selection posts were given to officers before the completion of the full 15 years' service, the attraction of service in the Provinces became greater than with the Central Government. (2) The grant of the right to take proportionate pension to officers serving under Provincial Governments and the withholding of this privilege from those serving substantively with the Central Government stopped all hope of recruitment to the latter service, for not only was no officer prepared to forego the privilege by accepting service under the Government of India, but, in addition, as the concession led to an immediate resignation of many of the senior men, the prospects of promotion, with all its attendant advantages, became far better in the service under Provincial Governments.

These concessions prevented recruitment to the central department of experienced members of the provincial departments, while, on the other hand, the scheme of Indianisation of the department not only resulted in the cessation of further recruitment to the I. A. S., but also in the appointment of recruits with little experience to the new and vacant posts at Pusa recently placed outside the cadre of the I. A. S., who can have little immediate influence with provincial departments staffed by senior and more experienced officers.

(3) Further, the principle that any services rendered by officials of the Central Government to a provincial department are liable to form a charge on the latter has had an appreciable effect in restricting co-operation between the central and the provincial departments. All these factors have combined to produce a line of cleavage between the several Agricultural Departments in India, have led to an increasing isolation of the central department and have removed hope of a continuation of central influence under existing conditions to a remote distance.

The central department, however, still exercises a certain modicum of influence through Muktesar, the Imperial Institute of Animal Husbandry and the Research Institute at Pusa but only—apart from the personal influence of any individual officer—through those activities which any particular provincial department may be deficient in, or devoid of. It has practically no influence, if one excepts the publication branch, in co-ordinating the activities of one Province with another. From the agricultural point of view the provincial departments are practically independent entities, owing no allegiance to India as a whole, and the wider view of the general progressive well-being of Indian agriculture and the international relations of Indian agriculture is, therefore, in grave danger of submersion.

The central department which has under its purview these wider considerations is thus left stranded as an isolated body unable fully to exercise that influence which is its prerogative.

The necessity for the central department being placed in an advantageous position for the due performance of its responsibilities requires little demonstration and it is apparent that some organisation must be created which will enable the central department (1) to keep in touch with the work done by the several Departments of Agriculture, (2) to give advice and formulate definite policies of development, (3) to promote all schemes which make for the general advancement of agriculture in India, (4) to stimulate and increase the volume of research work annually produced particularly in relation to problems which are definitely not local in character, and (5) to be in a position to take prompt and effective measures to prevent the introduction of crop pests and diseases from outside India and also from one Province to another.

What seems to be required is an organisation which will promote free co-operation between those engaged on identical or allied work and not a central co-ordinating body so frequently associated with central control which cannot prove acceptable to departments and ministries who have been granted provincial autonomy. Any organisation to prove successful must obtain the voluntary support of the departments and in fact be of such a character that they will willingly seek its co-operation, help and support.

Several suggestions have on occasion been put forward, the most prominent one and the one which first naturally comes to mind through obvious analogies, is the institution of an organisation based on lines closely following that which has been evolved in the United States of America. This is essentially one of a strong Central Federal Department working in close co-operation and contact with the various States departments, but a close examination leads to the conclusion that such an organisation cannot be successfully transplanted to India in present circumstances. Apart from the obvious serious financial burden which would be thrown on the Government of India, the outstanding feature is that the Federal Government in the United States of America exercises an executive and administrative control over many Government functions throughout the whole of the States, (*e.g.*, the passing of the Grain Standards Act which aims at bringing about uniformity in the grading of grains; the Federal Reserve Act which authorises national banks to lend money on farm mortgages; the Federal Farm Loan Act which created a banking system suited to the farmers' needs; the Food and Drugs Act which forbids adulteration; the Hatch Act and the Adams Act which make provision for grants for furtherance of agricultural research and education).

The Central Department of Agriculture therefore functions continuously throughout the whole country and thereby is in intimate contact with local conditions. No similar system of legislation is in operation in India and neither under the present system of devolution and administration of transferred subjects does it appear probable that it will originate in the near future. Consequently, the formation of a Central Department of Agriculture, based on the model of the United States of America would be largely inoperative in that it would carry with it no real bridge between its sphere of operations and that of the provincial departments. If and when a system of Federal Government is developed in India, then the proposal might be more seriously considered. Until such a change comes about, some simple and less ambitious scheme must be adopted.

Another proposal is that all agricultural research in India should be carried out under the aegis of the Government of India. This would connote the taking over by the Central Government of all the research activities of the Provincial Governments, thereby relieving the latter of present serious financial commitments and permitting them to apply the funds thus liberated to direct agricultural development. Consideration, however, shows that unless the Government of India were prepared to meet a very considerable additional expense in developing the scope and cadre of their present department, there would be no immediate increase in either the volume, kind or scope of the research work turned out and that most of it would still continue to be strictly local in character and application. Advance in agricultural research and knowledge will not be acquired by merely transferring the present onus of the Provinces on to other shoulders, but by developing the present situation. The proposal does not do away with the necessity of a bridge between the activities of the central and provincial departments. All it does is to transfer the present gaps between the departments to points more remote and localised, *i.e.*, between research officers working on local problems and the agricultural officers responsible for the development of local agricultural operations.

From a consideration of the above it becomes clearer that the required organisation must be supplementary to the existing one, which is quite capable, under able administration and control, of covering the general requirements of a Province, so that being independent of provincial boundaries it can com-

sider agricultural problems in a wider sense, can carry on investigations covering broad agricultural areas, crops and problems, and by the provision of suitable means can give effective help, either financially, or otherwise, to provincial departments as occasion arises. Without interfering with local administrative problems and without resorting to executive orders, it must be able to obtain the co-operation of the Provinces by the beneficial character of its functions. Fortunately in India we have an example of such a central organisation in the Indian Central Cotton Committee and its activities point the way to a satisfactory general solution of the problem. This body is of recent formation, yet in the brief period of its existence it has been able to influence in a most marked manner the improvement and development of cotton interests throughout India, and that with the willing co-operation of the provincial authorities concerned.

The organisation and activities of this Committee will have been placed before the Royal Commission in full detail and there is no necessity to refer to them here except briefly to state that in each cotton Province there is a Provincial Cotton Committee composed of all interests, which is in direct communication with the Central one by means of representatives. The latter therefore represents all interests throughout India and is in a position to consider problems from a very broad standpoint and thus exercise a very real influence. In addition the Central Committee has funds at its disposal obtained through the cotton cess and these funds are utilised for the furtherance of research on cotton investigations of all types. It maintains its own research institutes and affords facilities for carrying on and extending the work done by the provincial departments. It is in fact a live co-ordinating force in regard to cotton problems and this co-ordination is not brought about by compulsion but by inducing co-operation.

In the Indian Central Cotton Committee appears to lie the germ of future successful development of all Indian agricultural research and of inducing active co-operation between the Provinces themselves and between the Provinces and the Government of India by fostering the formation of similar central bodies specially to deal with the major crops and agricultural problems of India and in direct control of the Government of India, but given a certain freedom in the use of the funds allotted to them. Such committees would be at liberty to run their own research stations and be in direct contact with similar provincial committees thus co-ordinating the work of several Provinces.

Such an organisation has the great advantage that only the most urgent and important subjects would be considered in the first instance and as funds and opportunity permitted, future extensions could be made. It would be in fact a fluid organisation capable of being developed as the needs and interests of Indian agriculture opened out. Among the outstanding subjects first to be considered are:—(1) such crops as wheat, rice, oil-seeds, sugarcane, fibre crops, tobacco and the major cereals and pulses, (2) the problems of crop protection both internal and external, (3) agricultural engineering and irrigation problems, (4) agricultural economics, finance and co-operation, (5) animal husbandry and dairying.

The financing of the several committees would have to be arranged on varying lines, some might be financed by export duties or cesses, some probably by provincial contributions and others directly out of the central revenues, but in all cases it seems necessary that funds should be at the disposal of the individual committee subject to such general rules as are considered desirable.

A scheme of this character would result in co-ordinating the work of the Provinces with research promoted by the central authority, yet a further provision must be made for co-ordinating the activities of these several separate organisations within the purview of the Central Government. To bring this about it is suggested that the readiest method is to constitute a permanent Board of Agriculture directly under the administration of a Member of the Executive Council consisting of a few experienced members

selected for their ability and knowledge, each dealing directly with a definite portfolio, and each being in direct contact with the appropriate central committee or committees. I would suggest the following arrangements as suitable:—

- 1st Member deals with Animal Husbandry and Dairying and Veterinary.
- 2nd Member deals with Plant Industry.
- 3rd Member deals with Crop Protection.
- 4th Member deals with Agricultural Economics including agricultural co-operation and finance.
- 5th Member deals with Irrigation and Agricultural Engineering.

Such an organisation can reasonably be expected to play a very important rôle in the sphere of internal development of the agricultural resources of the country and appears almost indispensable in the circumstances ruling at present. An advisory committee to replace the present Board of Agriculture and to consider the general aspects of Indian agriculture can be formed by representatives deputed from the several committees and the members of the permanent Board of Agriculture.

The points raised in the Questionnaire may now be dealt with *seriatim*.

QUESTION 1.—RESEARCH.—(a) Under the provisions of the Devolution Rules, 1920, framed under the Government of India Act, 1919, Agriculture is a Transferred subject and the organisation, administration and financing of agricultural research in the Provinces has now devolved on the Ministers who are responsible for them to the Provincial Legislative Councils. The Government of India exercises no control over these provincial departments which concern themselves solely with the agricultural development of the Provinces, and with agricultural research which, in general, has a definite bias determined by local conditions and crops. The development of these provincial departments consequently will be determined mainly by purely provincial considerations which do not fall within the immediate purview of the Government of India who are responsible only for central research on problems of All-India importance.

The activities of the central department at present cover a fairly wide field, namely, general research on chemistry, bacteriology, mycology, entomology, the raising of improved crops, breeding of new varieties of sugarcane, investigations connected with animal husbandry and dairying, animal nutrition, control of animal diseases (and one may also include here the activities of the Indian Central Cotton Committee) and serve as a basis for supplementing the work of the provincial departments. Many agricultural problems in India are not confined by the limits of political boundaries but are spread over several Provinces and it is to such problems that the energies of the central department should be mainly directed.

Hitherto, the organisation of the departments has in general followed the stereotyped lines of providing a staff comprising agriculturists, botanists, chemists, etc., working semi-independently of one another and confining their attention to subjects clearly identified with their special knowledge. Owing, mainly, to the comparatively small number of experts available, there has been no systematic attempt to associate them on definite lines of research, but when some pressing problem has presented itself for investigation such associations have been brought into operation either by the administrative Heads of the departments or by voluntary co-operation of interested experts. These associations have been of a temporary character and have been dissolved when a solution has been attained, but the position now developing would appear to indicate that future organisation must aim at associating various experts on a definite problem or group of problems. As the central department is to deal with the development of research of more than local importance, it would seem desirable to organise it on these lines. A central organisation for the administration and financing of agricultural and veterinary research throughout India on lines which have proved efficacious in some

advanced countries does not appear possible under the existing conditions brought about by the Reforms as there is every likelihood of the Provincial Ministers and the local Legislative Councils strongly resenting any outside interference in local matters, and neither does it appear desirable that the Central Government should assume responsibility for the conduct of all research carried on throughout India.

It is suggested that this object can be attained most readily by adopting and developing the ideas leading to the formation of the Indian Central Cotton Committee, namely, by creating a number of similar central committees each dealing with a clearly defined field of investigation and provided with adequate funds for carrying on the work. Each committee would be intimately associated with provincial committees and also with a permanent Board of Agriculture comprised of a few experienced officials. There would thus be evolved an organisation whereby the provincial departments would maintain contact with each other and the central department. Research would be fostered by recruitment of special staffs, thus increasing the number of expert officers employed under the Central Government and permitting assistance being given to provincial departments whenever considered to be necessary. Such assistance should be paid for out of central funds, even when applied for by a local department, otherwise the present tendency for isolation will be continued.

For several years following upon the formation of the Indian Agricultural Department, the meetings of the Board of Agriculture afforded facilities whereby the scientific experts were enabled to meet together and discuss their problems and difficulties. Subsequently the restriction of the membership prevented this occurring with the result that these experts only rarely come into intimate contact with their colleagues in other Provinces. To remedy this state of affairs, sectional meetings of the Board were instituted, but after a few years financial difficulties rendered it extremely difficult to bring together a fully representative gathering and the scheme has been in abeyance during recent years.

The suggestion that central committees should be instituted to consider broad agricultural problems appears to offer an effective mechanism whereby the present state of affairs can be remedied and research officers brought into intimate personal contact with their colleagues and others working on similar problems. If financial considerations should offer an obstacle, then the expenses involved should be borne by the central authority.

Whatever may be the ultimate organisation of the central department, it appears desirable to institute one change in the immediate future. For many years the Pusa Institute was the only one under the Central Government dealing with broad agricultural problems and those connected with cattle-breeding naturally received considerable attention. Valuable results were obtained and the scope of the work was expanded. Until now the farm portion is devoted almost entirely to the raising of fodder crops for the herd with the result that the major staple crops of India are not cultivated. This Institute is staffed by expert officers whose interests are mainly centred on the latter type of crops and the cultivation now practised therefore only partially fills their needs. This being the case the transference of a portion of the cattle-breeding operations to the recently acquired farm at Karnal seems to be desirable, or alternatively to extend the culturable area within the Institute.

In conformity with the original scheme of organisation the Pusa Institute was staffed with an Agriculturist, Chemist, Botanist, etc., and provision was also made for the employment of a supernumerary in each section so that each section was under the control of two Imperial Service officers. Many of these supernumerary posts were subsequently converted into second posts, i.e., Second Imperial Mycologist, etc., and each section was adequately staffed with both gazetted and non-gazetted assistants. Little expansion took place in subsequent years with the result that many of the Provincial Institutes contained a larger staff of workers than the Central

Institute, and in addition, since the advent of devolution, the policy has been followed whenever possible of abolishing the second posts so that in recent years no increase in either the volume or scope of research work has been possible but rather the reverse.

The position may be illustrated by the developments in the Chemical Section. In 1917 when I took over charge there were employed two Imperial Service officers, two gazetted assistants and 6 non-gazetted assistants. With the creation of the post of Physiological Chemist and subsequent transfer to Bangalore, the section lost the service of one gazetted assistant; and the Supernumerary Chemist, whose post is to be abolished when opportunity occurs, has been absent through officiating in other departments. The Physical Chemist has only recently been appointed and the services of one assistant have been permanently placed at his disposal and possibly in the near future another also will be necessary. Allowing for absences due to leave and illness, the effective strength of the staff of the Imperial Agricultural Chemist is reduced to one Imperial Service officer, one Provincial Service officer and four assistants which is barely sufficient to carry out the ordinary analytical work which falls to this section to perform and very little opportunity is available for research work. The position is further complicated by the fact that the present Imperial Agricultural Chemist is also Joint Director of the Institute. When the sanctioned post of Biological Chemist is filled, there will be a further demand thrown on the Imperial Agricultural Chemist's staff. The laboratory accommodation available for the Physical Chemist is totally inadequate and no provision is available for the Biological Chemist. Proposals for the employment of additional gazetted and non-gazetted assistants have been submitted, together with proposals for the provision of laboratory accommodation for the two sanctioned posts referred to above.

QUESTION 4.—ADMINISTRATION.—(a) In the general note covering Questions 1 and 4 attention has been drawn to the fact that with the introduction of the Reforms there has developed a tendency for the several Agricultural Departments in India to become isolated units and that there is little co-ordination of their activities between themselves and the central department. At present the only co-ordinating influences are the personal relation between the various officers and the publications issued by the various Governments. The experts of the central department keep in touch officially with provincial officers through the compilation of annual reports recording the progress of research throughout India and personally through tours taken in connection with their work, but in recent years the opportunity for such tours has lessened mainly through the fact that Provincial Directors are loth to call for their services as this would throw unforeseen charges upon their budgets. The same factor operates in preventing the services of central officers from being utilised for examination purposes, one of the most useful means of maintaining contact. In addition, annual reports are issued giving a detailed account of the research work in progress at Pusa and including a programme of future work.

The influence of the present Board of Agriculture in this direction has also waned in recent years due to the restriction on the number of expert officers attending as members and visitors; to the fact that officers chosen to attend are selected mainly according to the subjects under review; and also that meetings are only held biennially. For similar reasons the sectional meetings of the Board have lost their value and it has become increasingly difficult to obtain a representative attendance sufficient to justify the holding of the conferences.

In view of the above, it must be candidly admitted that there is a break between the activities of the central and provincial departments and also between the latter themselves, which must be bridged if the general agricultural conditions are to be improved, and it has been suggested in the general note that this can best be attained in present circumstances by the scheme outlined therein which would, in addition, permit the Government of India to supplement the operations of the local departments by developing research facilities on a broader basis than at present.

Apart from this line of development there are other special directions in which the Government of India may usefully supplement the activities of Local Governments:—

- (1) Creation of a section of Agricultural Engineering at Pusa with the necessary staff and workshop to investigate the use of agricultural power machinery with special reference to motor ploughs and tractors.
- (2) A technological laboratory attached to the Engineering Section for technological investigations arising out of the work of the scientific staff of the Pusa Institute and the provincial departments.
- (3) Investigation of sugarcane pests and diseases by appointment of additional officers.
- (4) Study of the technique of sugar and *gur* manufacture by the appointment of a Sugar Technologist.
- (5) Study of the curing processes of tobacco by appointment of a Tobacco Curing Expert.
- (6) Study of the problems relating to crop nutrition by appointment of (a) Plant Biological Chemist, and (b) Plant Physiologist.

Of these problems, items (1), (2) and (6 (a)) have received sanction of the Secretary of State for India but along with other proposals relating to the scheme for reorganisation of the Agricultural Research Institute at Pusa, drawn up by the Government of India in 1921, have not yet been given effect to.

(b) It is conceivable that provincial departments would avail themselves of the services of experts on the central staff for the purpose of carrying out special investigations likely to be of a temporary character if such experts were available, but in present circumstances, the staff employed by the Central Government is inadequate for the purpose. A scheme such as the one outlined in the general note would result in the Government of India having under its control a considerable number of officers and it should be possible readily to meet any demands for assistance of a special nature arising from the Provinces.

Recruitment to the central department.—A reference has been made to the difficulties experienced in recent years in regard to recruitment to the central department and, if that department is to expand and at the same time maintain an authoritative position relative to the provincial department, it would appear desirable that future recruitment should be placed on the widest possible basis, so that recruits possessing the widest experience and standing would be attracted. The terms of service should be liberal so as to induce an unrestricted choice and it is suggested that one means of attaining this is to re-introduce recruitment to the Imperial Agricultural Service so far as the central department of agriculture is concerned.

Recruitment, for the proper functioning of the proposed committees, will necessarily require long service recruitment in the majority of cases but it is conceivable that, for investigations of a very specific character which require the services of experienced experts and which are not likely to extend beyond a limited term of years, short-term recruitment must be resorted to.

QUESTION 2.—AGRICULTURAL EDUCATION.—The central department of agriculture does not impart a general education in the theory and practice of agriculture and the allied sciences. Such education is provided by the six Provincial Agricultural Colleges at Poona, Coimbatore, Lyallpur, Nagpur, Cawnpore and Mandalay, the first four of which are affiliated to the local Universities and award a degree in agriculture and the last two give a diploma in agriculture. These colleges cover the greater part of India, but the whole of North-East India, comprising the Provinces of Bihar and Orissa, Bengal and Assam, is unprovided for and consequently these Provinces are not in a position to provide agricultural teaching based on local conditions

Dr. W. H. Harrison.

for the training of students. The existing colleges are as a general rule provided with staffs sufficient to meet existing demands, but the officers also are required in many cases to carry out the work required by the local departments comprising investigation, analysis, advisory functions, propaganda, etc. This leads to the officers having their energies diffused over a very wide field and the Madras Department has, as a consequence, taken the step of separating education from general departmental work by appointing separate staffs. This development leads to increased efficiency by increasing the number of officers available for research and investigation and is one which will have to receive ultimately the careful consideration of all provincial departments.

The position which the Central Institute at Pusa occupies in relation to the provincial activities, is that of a higher teaching institution to enable students, by means of post-graduate courses, to qualify for the higher appointments in the Agricultural Service. At present such courses, which involve training in methods of research and last for 2 years, are given at Pusa in agricultural chemistry, botany, mycology, entomology and agricultural bacteriology.

Only graduates of Indian Universities or agricultural colleges, who are considered fully qualified to take advantage of the courses, are admitted for training, the selection being made by a Board presided over by the Agricultural Adviser to the Government of India.

(i) For post-graduate training the supply of teachers and institutions under the Central Government is sufficient to meet the present demand, but if any material increase in this demand develops through the future expansion of the departments, increased facilities will be found necessary. The accommodation in the laboratories is limited and as there are at present no second officers in the various sections the staff would need strengthening.

(iv) The main incentive for students to enter the agricultural colleges is the hope of subsequently obtaining entry into Government service. Outside Government service there is practically no prospect of private employment and the landholding class have not shown hitherto any marked tendency to employ agricultural experts in order to help them in the management of their estates.

The attendance at the colleges is as a consequence (and this applies to post-graduate training as well) subject to considerable fluctuation from year to year. When there is a prospect of any department expanding with a concurrent increase in the prospect of service there is a rush of applicants which lessens immediately the demand for recruits is satisfied. The absence of future prospects of employment for post-graduate students at Pusa has reacted in reducing the number and quality of applicants. In present circumstances it is submitted that the most satisfactory means of utilising the facilities for post-graduate training at Pusa would be for the provincial departments to depute approved members of their services.

The normal rate of recruitment to the departments is small and out of proportion to the potentialities available in the colleges and there are in India at present a number of qualified graduates without hope of remunerative employment. In addition there are available a large number of highly qualified graduates of foreign Universities, etc., in the same category.

(v) Students are mainly drawn from the educated middle classes and the number representing the actual cultivating classes is small.

(vi) No modifications in existing chemistry courses of study at Pusa appear to be necessary at present. The training given is individual in character and can readily be modified to suit requirements.

(vii) The majority of students who have gone through these courses are in service in the various Agricultural Departments.

ORAL EVIDENCE.

A.2341. *The Chairman*: Dr. Harrison, you are the Imperial Agricultural Chemist and the Joint Director?—Yes.

A.2342. You have given the Commission a note of the evidence that you wish to give. Do you desire at this stage to say anything in amplification of that?—No.

A.2343. Would you give the Commission an account of your own training and past appointments?—After graduating I was appointed Research Chemist to the Leeds Corporation to carry out their experiments on the bacteriological treatment of sewage and subsequently was placed in charge of their works and farms. During that period I gave evidence on three or four occasions before the Royal Commission on Sewage Disposal. At the conclusion of the experiments I accepted a post under the Government of India and was posted to Madras, remaining there till 1917, when I was transferred to Pusa to take up the post of Imperial Agricultural Chemist. In 1921 I was appointed Joint Director in addition to my duties as Imperial Agricultural Chemist and I have been in that position ever since. On three separate occasions I have officiated as Agricultural Adviser to the Government of India.

A.2344. Would you tell the Commission how your responsibilities are divided as between yourself and your colleague?—During the residence of the Agricultural Adviser I deal with the internal economy of the Institute, *i.e.*, with the necessary services such as the supply of water, gas and electricity, and with sanitation and the general upkeep of the Estate, as apart from the Farm. I have to deal with all the financial transactions of the Institute as a whole. During the absence of the Agricultural Adviser I have to deal with certain matters which normally fall to his lot.

A.2345. What matters have you to deal with in the absence of the Agricultural Adviser?—Very often I act as controlling officer and have to deal with questions of travelling allowance and general sanctions. I have also to carry out a certain amount of routine work in regard to publications. I do not, however, deal with the editorial work.

A.2346. Are you responsible for the co-ordination of the work at times when the Agricultural Adviser is absent?—Whenever the necessity arises.

A.2347. How about the suitability or otherwise of the site at Pusa for this Institution?—From my professional point of view I have no objection at all to the site. It is exceedingly suitable for every department of agricultural chemistry and I do not know of a better place. The objection is the isolation of the place.

A.2348. Do you regard the inaccessibility of this place as a serious hindrance?—It prevents people visiting the place who would otherwise do so. It also prevents our getting away easily and for short tours.

A.2349. How about the co-ordination of the work of the various sections at Pusa?—I do not quite understand what is meant by the word co-ordination. In what sense is it used?

A.2350. I will tell you what I mean by the question. I am thinking of work done by several sections in common, *i.e.*, several sections working together on any particular problem?—In other words, the necessity for co-ordination only arises when a problem emerges which requires two or three sections to work on it. In that case the co-ordination is quite satisfactory here.

A.2351. Have you any criticism to make on the internal organisation of this research station?—Personally, none. There is dual control, but personally I have no objections to raise.

A.2352. How about the touch between this station and the Provinces?—It is purely personal, depending on the Heads of Sections very largely.

A.2353. Do you think that it is satisfactory as regards all the major Provinces?—No.

A.2354. Would you amplify that a little?—I think I have made it quite clear in the note I have submitted to the Commission that there is a hiatus now between Province and Province and between each Province and the Government of India. I have nothing to add to what I have already stated in my note.

A.2355. I think you have heard what some other witnesses have had to say about the difficulty of obtaining the necessary sanction for journeys from this place to the Provinces in order to carry out work there? Do you wish to say anything about that?—I know of no instance where a man has been refused permission to tour the Provinces at his own request or where he has not been properly supported.

A.2356. Do you mean refused permission by the Government of India?—No, refused by the Agricultural Adviser as the controlling officer.

A.2357. Is it within the power of the Agricultural Adviser to sanction every journey which he thinks necessary in the interests of the work?—It is within the power of the Agricultural Adviser to withhold sanction to any proposal for a tour and also to withhold the payment of any travelling allowance bill if he is not satisfied that the expenditure has been properly incurred.

A.2358. Do you wish to say anything about post-graduate training in the Institute?—Not in a general sense. I would rather answer specific questions.

A.2359. I have read carefully through your note and I quite appreciate your views. You have made them perfectly plain and there are just one or two questions I should like to ask you. I gather that you are impressed with the success of the Indian Central Cotton Committee and its work?—Yes. I have twice officiated as Chairman of that Committee.

A.2360. The difficulty of arranging some of these organisations lies largely in the difficulty of financing them, does it not?—Exactly.

A.2361. One can conceive a method by which, for instance, jute can be organised and financed. Do you think that it might be possible to arrange for an organisation of the oil-seed interests on similar lines?—I do not think so. It might be possible, but I have not gone into the question of finance. I have carefully formulated a scheme which I think would answer the purpose I have in view. The question of finance I should like to leave to people more acquainted with it.

A.2362. Have you noticed a growing isolation of Pusa since the Reforms were instituted?—Most certainly.

A.2363. Would you agree with me that the opportunities of the staff at Pusa to have their recommendations listened to rest at this moment almost entirely on their individual reputation?—Purely and simply on their personal relations with the Provinces and their reputation with the scientific officers there.

A.2364. What have you to say as to the prestige that Pusa enjoys at this moment? Do you think it stands high in the Provinces or not?—I think it does. Of course, it is only natural that they should prefer to run their own show without outside interference, and having served in a Province myself I quite appreciate that point of view. They are afraid, I think, of accepting domination from any outside body.

A.2365. It is the case, is it not, that vacancies at Pusa do not attract officers in the Provinces in the way one would hope they would?—In later years it has been impossible to recruit from the Imperial Service in the Provinces to Pusa. The prospects at Pusa in the early years were quite distinctly better than in the Provinces and we could recruit then, but in later years, particularly with the changed scale of emoluments, the prospects in the Provinces are brighter than they are at Pusa.

A.2366. Do you think that it will be possible in the future to maintain the prestige, the reputation and the usefulness of Pusa if the posts at Pusa are less attractive than those in the Provinces?—No. My object in formulating the scheme I put before you was to create a number of attractive posts which would attract to the Central Service the best men possible.

A.2367. *Sir Henry Lawrence*: You referred to some change in the system of pay; what change were you referring to?—It was the introduction of the selection grade posts in the Provinces. Previous to that, there was one grade of pay throughout the Service, and the officers deputed to Pusa, and who served under the Central Government as Heads of Sections got a separate personal allowance. With the introduction of the new scale of pay, which runs, I believe, to Rs. 1,250 normally, the Pusa allowances were increased in proportion. But in addition to the maximum of Rs. 1,250, selection grade posts were introduced running from Rs. 1,500 to Rs. 1,750, so that the position of the Head of a Section at Pusa became only equivalent to the position of an officer serving in a Province in the selection grade and also as Principal of a college. In addition to that, it was laid down that selection grade posts should not be given until a man had served 15 years, but exceptions were made, and men have been promoted to the selection grade in Provinces at a much earlier date. Consequently, the hope of promotion to higher pay is greater in the Provinces than at Pusa.

A.2368. You do not suggest that the immediate prospects in the Provinces are excessive?—Over and above that, owing to the action of the Reforms in introducing retirement on proportionate pension, many of the senior men in some Provinces have retired, and in those Provinces men comparatively junior have received early promotion.

A.2369. Was any attempt made to equalise the position of the men here to the former comparatively higher standard? Was any proposal put up to the Government of India and turned down? Previously, the staff at Pusa were comparatively rather better off than the staff in the Provinces. When the staff in the Provinces had their prospects and pay improved, was any proposal sent up from Pusa to have a similar improvement made here?—Not to my knowledge.

A.2370. There has been no disinclination on the part of the Government of India to give any improvement here?—I am only speaking from my own knowledge. So far as I am aware, the question has not been put to them in the form in which you have put it, but when these scales of pay were revised, the Directors of Agriculture were permitted to draw extra pension on the lower scale on the Lee grade, but the Heads of Sections at Pusa were not included in that category. Representations were made to the Secretary of State, and now the Heads of Sections are included in the same category and draw extra pension on the lower grade. That is the only representation with which I am acquainted.

A.2371. *Sir James MacKenna*: The rates of pay fixed by the Lee Commission were introduced both in the Provinces and at Pusa?—Yes.

A.2372. *Sir Henry Lawrence*: There has been no representation made by the individuals affected here?—Not within my knowledge.

A.2373. What is the system in force here, governing the correspondence between Heads of Sections and local officers in Provinces?—They are permitted to correspond direct on all questions which do not deal with administrative affairs.

A.2374. What do you mean by administrative affairs?—They have a free hand to correspond with regard to their own work, but not with regard to anything which may affect the administration.

A.2375. Administration of what? Of their own section?—General administrative matters referring to the Agricultural Department as a whole. I rather think that the point was raised in the very early days, certainly outside my own personal knowledge, by some Madras officer. I think it was raised by the Madras Government, in the first instance. It was proposed (I am only speaking from recollection) that officers in Madras should be allowed to correspond direct with the Imperial officers, and this was agreed to, subject to the reservation that they must confine their correspondence to professional matters; otherwise, it must be carried on through the Head of the department.

A.2376. And, in your opinion, there has been no inconvenience and no restriction on useful work by the officers at Pusa being debarred from corresponding with provincial officers?—There is no restriction on an officer at Pusa corresponding with any of the officers in the Provinces on professional matters.

A.2377. If he is asked to go and investigate a local problem, he can go away on his own discretion?—It depends on how he places it before the authorities.

A.2378. On his own discretion?—No, he cannot go on his own discretion. Every officer here has to get sanction to go on tour from the Director; previous sanction is necessary.

A.2379. The Director may be in some other part of India?—There are two of us; when the Agricultural Adviser is away, the discretion lies with me as Joint Director.

A.2380. So that there is no necessity for any correspondence. He can come to you and say that there is an urgent problem awaiting investigation somewhere and he wants to tackle it?—He will get sanction.

A.2381. Does he take the sanction in advance or afterwards?—In advance. The justification is merely his statement that there is an important problem; he is the expert concerned, and his word is taken. But if he were to put up the proposal on the ground that the Director of Agriculture of that Province has asked him to go there, I am afraid we should come under the operation of the Devolution Rules.

A.2382. Can you mention the Devolution Rule in question?—I cannot mention any specific one; I can only refer to the general trend of the orders issued by the Government of India regarding the conduct of affairs.

A.2383. Could you put up the Government of India orders on the subject?—I think so; I cannot do it now.

A.2384. Will you send them up?—Yes. There are several points on which the Government of India have laid it down definitely and distinctly that the Central revenues are not to be expended on matters which fall within the legitimate sphere of work of a Province.

A.2385. Will you make a *précis* of those orders and send us copies of the actual wording of the orders from the Government of India on this point?—To the best of my ability, I shall do so; I will let you have whatever I can put my hands on.

A.2386. *Sir Gangz Ram*: You are the Imperial Agricultural Chemist; are you the Soil Physicist also?—No; there has been a new officer recruited to that post.

A.2387. There was going to be a new appointment?—There is one.

A.2388. Who is it?—Dr. Puri.

A.2389. On page 268, you advocate the creation of a new department here. You say, "Creation of a section of Agricultural Engineering at Pusa with the necessary staff and workshop to investigate the use of agricultural power machinery with special reference to motor ploughs and tractors." What about pumping? Do you not attach any importance to it?—I have no objection to pumping being included in it.

A.2390. If that department were created, would any of you be able to undertake it, or would you require another engineer to do it?—We should require special recruitment for it, a special officer.

A.2391. At present, do you teach your students questions relating to water?—I am not an agricultural engineer.

A.2392. In what do you help them? How far do your duties go?—I am not an engineer; I do not deal with engineering matters at all.

A.2393. You want to create an engineering section?—Yes.

A.2394. Do you teach the students in this institution enough to enable them to say how much land can be irrigated by a given quantity of water?—Are you referring to me personally, or to the Institute?

Dr. W. H. Harrison.

A.2395. You may call it both?—No, I cannot answer that.

A.2396. But you raise the question of creating an engineering section here and you refer to agricultural engineering?—You asked me if I did it; I do not. So far as the Institute is concerned, the Agriculturist deals with that matter. We have a pumping plant on the estate, and to that extent the students even now become acquainted with a certain amount of irrigation.

A.2397. Can they say what power is required to pump up a given quantity of water?—I cannot answer that question.

A.2398. *Sir Thomas Middleton*. You were the Imperial Agricultural Chemist here until 1921, and then you became Joint Director?—I am still the Chemist.

A.2399. I appreciate the fact that you are still the Chemist; it leads up to my next question. To what extent do you find the duties of Joint Director interfere with your technical work in Chemistry?—Very seriously. My duties as Joint Director on the average occupy me for 2 to 3 hours a day, and towards the end of the financial year probably the whole day. I should say, generally speaking, that I have only, at the most, about 3 hours a day to dispose of work outside the central office, of which I give as much as I can to my own section.

A.2400. Was any addition made to the staff of the department when they created the post of Joint Director?—No; I have been singlehanded.

A.2401. You yourself find no difficulties have arisen because of dual control and the fact that there are two Joint Directors?—No, it is purely a personal matter; our relations have been good, and so long as they are good, there is no difficulty whatever.

A.2402. But you recognise that a position like this is one which might very readily lend itself to difficulties?—I can quite appreciate that point.

A.2403. In your own experience, has there been any indication of it?—I can see many pitfalls.

A.2404. You have pointed in your evidence to the waning influence of Pusa in connection with the provincial departments, and you have indicated very clearly how that position has arisen. I think you will agree that any section of Pusa should be in a much stronger position than the corresponding section in any particular Province; that would be the ideal position?—In regard to staff?

A.2405. In regard to staff. We must take it first in terms of staff and ultimately in terms of prestige?—No; I think the real point is that the sections at Pusa should be free from interference through routine duty; the routine duties usually fall to the provincial staff; the Pusa staff should be free to carry out research work. They should be free to carry out their duties, duties which fall to each section as forming part of the central bureau of the Government of India. They should also be free to give full attention to a few carefully selected post-graduate students; but they should not be mixed up with the detailed duties which fall to the lot of the provincial departments.

A.2406. I was thinking of the difficulties you indicated, the lack of financial attraction offered by Pusa at present to provincial officers and of the effect of that in future on the quality of the officers who will be attracted here?—I think there is a factor which has been referred to and which is probably more important than the financial attraction, namely the fact that officers in the Provinces can retire now on proportionate pension, while officers serving directly under the Government of India are not allowed to do so. Officers are not going to sacrifice that privilege and take up a post under the Government of India.

A.2407. Will not that state of affairs be temporary?—Yes; I believe it ceases in 1929.

A.2408. So that after 1929 the former position of the posts at Pusa in relation to provincial posts will be re-established?—Except from the point of view of financial equality.

Dr. W. H. Harrison.

A.2409. Are the facilities offered by Pusa at present being fully utilised? By that I mean, could you without further capital expenditure accommodate a considerably larger staff in any of your sections?—No. Considerable financial expenditure will be required if that is to be done, not merely in providing larger laboratory accommodation but in providing greater residential accommodation.

A.2410. Are the existing benches in all the laboratories occupied at present?—I know they are in mine. I cannot answer for all.

A.2411. You point out in another connection the value that has attached to the meetings of the Board of Agriculture in the past and the fact that these meetings are less frequent than before. Is the cost of a meeting heavy? Has that been worked out in connection with the meetings at Pusa?—Not the total cost. That includes the cost of the travelling allowance for all the officers attending. That has never been worked out.

A.2412. From the information at your disposal could you give a rough estimate of the cost of holding a meeting?—I could make a rough estimate. If you require one from me I can work out one.

A.2413. *Mr. Calvert*: Half a lakh of rupees?—Probably.

A.2414. *Sir Thomas Middleton*: You have had long teaching experience in Madras?—Yes; I originated the chemistry courses there.

A.2415. Have you formed any impression as to the supply of students in the superior agricultural colleges in India? Have you now got a sufficient number of colleges in India to meet the requirements?—There is a college in most of the major Provinces except in the eastern part of India, by which I mean Bihar and Orissa, Bengal and Assam; there is no college in that area.

A.2416. You have not heard of any strong demand arising for a college in any particular area?—No. I think there is such a demand now in the Telugu districts of Madras.

A.2417. With regard to the training of men in your own subject, chemistry, what type of training would you desire in the assistants you recruit for your research work?—I demand a good general knowledge of chemistry with a fair knowledge of the technique of practical chemistry and also I demand a good character. I think these are the first essentials.

A.2418. I think Indian Universities are devoting a very considerable amount of attention to chemistry. Have you found that the quality of your assistants in different parts of India has been satisfactory?—I have not had the privilege of recruiting a single assistant in my section since I came to Pusa except by transference from the Indigo Section, which was abolished.

A.2419. Previously in Madras?—I had no difficulty in Madras.

A.2420. You were successful in getting some very good assistants?—I would refer to Mr. Visvanath, at present the Government Agricultural Chemist in Madras, who compares very favourably even with those of European standards.

A.2421. *Dr. Hyder*: What are these concessions made by the Lee Commission to which you refer in your note of evidence? What concessions are you referring to which you say are given to the provincial agricultural officers?—The concession to retire on proportionate pension and also the concession of a selection grade.

A.2422. Taking the matter of retiring on proportionate pension, you are aware that the position of an officer in the Central Service in the field of agriculture is the same as it was before the introduction of the Reforms; is that not so?—It is stated so on paper. I cannot altogether accept it. It is not the same; we are affected indirectly by the operation of the Reforms throughout India.

A.2423. But constitutionally your position as stated clearly by the Lee Commission *vis a vis* the Assembly remains where it was?—Constitutionally it remains the same. I can accept that.

Dr. W. H. Harrison.

A.2424. And that concession to the officers operating in the Provinces on the introduction of the Reforms was given on the ground that they might not like to serve under Ministers?—That is quite true.

A.2425. But no change has taken place as regards the position or the careers of men who are still in the Central Service?—None at all. That was not my point. My point was that the recruitment of officers serving in the provincial departments to the central department has been affected.

A.2426. You know many of these officers took advantage of the concession?—Yes; a large number.

A.2427. Then you complain further on in your note of evidence that Pusa has had the misfortune to be staffed by comparatively junior men?—That is in the last few years. We tried to obtain senior, experienced men for two posts here and we could not recruit them.

A.2428. But these senior, experienced men to whom you are referring are men who are engaged in administration and not in research which is primarily the function of this institution?—No; I am referring to officers engaged actively in research in the Provinces whom we wished to recruit to Pusa. I am also referring to the case of persons who have specialised training whom we could not recruit here because in that case the Government of India would not sanction the post for a period of more than five years; it was a temporary post.

A.2429. *The Raja of Parlakimedi*: What experiments do you do to study the requirements of the soil?—I have not taken up that enquiry particularly here.

A.2430. As regards the supplementing of nitrogen on the soil what crops do you suggest should be grown?—Leguminous crops.

A.2431. What is the best crop for that purpose?—I am not an agriculturist. I have not made a specific study of that subject.

A.2432. While you were at Coimbatore did you consider what the best rotation crop would be after paddy?—I did not, because all the paddy lands I was acquainted with and worked on were simply paddy lands, except in the Kistna, where *sann*-hemp was grown as a casual crop towards the end of the paddy season.

A.2433. Do you not think the growing of green gram as a rotation would serve the purpose better for paddy?—I am speaking of my experience of 10 or more years ago, and I can only speak with regard to irrigated paddy, that is, paddy in land which is kept under several inches of water throughout the whole period. In that case I do not think it is advisable to grow a second crop. I do not think, from my recollection of Madras, that under those circumstances it is advisable to go in for a second crop.

A.2434. How about leaving it fallow for one year?—I do not think you can gain anything by that. Paddy is a crop that seems to make a very small demand on the soil; it is a crop which is very easily cultivated, and I do not think you would gain anything by allowing ordinary paddy land to lie fallow. If there is salinity or other defects you might allow it to remain fallow.

A.2435. Conditions in Italy are I believe so different from those in India that in Italy they very frequently have a rotation of paddy and fallow?—Quite so, and the conditions of paddy cultivation vary throughout India from one Province to another so that it is very difficult to lay down hard and fast rules on points of that nature.

A.2436. There is nobody here to tackle the point so far as this part of the world is concerned, is there?—We cannot do it here because we have no paddy land on the Institute; but paddy cultivation is under review by the Bihar and Orissa department.

A.2437. Do you know whether anything is being done there?—They have paddy farms, they are selecting seed grain, and they have manurial experiments going on.

A.2438. For merely experimental purposes it is not very difficult to prepare land for growing paddy, is it?—No, but at present the bulk of the farm is required to feed the herd of cattle here; and even if we could convert part of

the farm into paddy land, that fact would probably operate against introducing paddy cultivation here under present circumstances.

A.2439. *Sir James MacKenna*: Have the duties of the Joint Director increased materially in recent years?—Every year sees an increase.

A.2440. You have held that post off and on since 1921, I think?—Yes, for 5 years.

A.2441. When the post of Joint Director is held by the Head of an important section, do you think it materially affects the amount of time he can devote to his scientific work?—In my own instance it has seriously affected the amount of time I can personally devote to research in my section. For that reason my work now is to sketch out roughly the problem, and when I feel on fairly safe ground, to turn it over to an Assistant to work out in detail, under my guidance, of course.

A.2442. Would you recommend the revival of the post of Assistant to the Agricultural Adviser, or what other method would you suggest to meet this difficulty of the loss of scientific research which accrues from the Head of a Section having to discharge the onerous duties of Director?—Personally I think the solution lies in separating the post of Agricultural Adviser from that of Director.

A.2443. You would have a separate Director for Pusa?—Yes.

A.2444. Would his duties be those which are now discharged by the Joint Director, or would he take over some of the duties which now fall upon the Agricultural Adviser?—The bulk of them are those which now fall to the Joint Director, but he would have more time to attend to the details than the Joint Director has now.

A.2445. For instance, would he be President of the Pusa Council?—Yes.

A.2446. And would act as the co-ordinating officer of the scientific branches of the Institute?—Yes.

A.2447. What has been the recruitment of agricultural chemists to the Imperial Service during the last 10 years? Could you give me a rough figure?—There have been three recruitments of European officers, one of whom has since resigned; one to Bengal, one to the Punjab, and one to Burma. Promotion from the Provincial Services has occurred in Madras, Bombay and the United Provinces.

A.2448. That is six vacancies in 10 years?—Yes.

A.2449. Do you anticipate that the vacancies in the ensuing 10 years will be less or more?—If the scheme I submitted is acceptable, I anticipate there will be quite a number of vacancies in the near future, not only of chemists but of other scientific officers.

A.2450. With reference to the Indianisation of the Service, which you know is an accepted principle of Government, do you think the post-graduate courses here should be limited to men selected or nominated for appointment, or should be extended to private students who want to work on a special branch of chemistry?—In view of the few posts which are available, I think it ought to be limited to nominations by the Provincial Governments or by the Government of India; I think it is unfair to turn out a number of highly trained men who can find no resting place within India.

A.2451. So that, accepting that policy, the present rate of recruitment to the post-graduate courses in chemistry at Pusa are in your opinion adequate; it contemplates four?—It contemplates four, but actually I have only had three, of whom one resigned after a month's trial, and none have been recruited during the last year.

A.2452. So that you do not think the idea of post-graduate training at Pusa requires any more emphasis than has already been given to it?—Not until the necessity arises.

A.2453. I suppose you would welcome an officer who desired to work on a special piece of research here, if you could find laboratory accommodation?—

Dr. W. H. Harrison.

Yes, provided it was agricultural research; I should not welcome an officer coming here to do general research.

A.2454. Do you think the Universities could be approached to recognise research work done here for the higher degrees of the Universities, such as the D. Sc.; do you think it is worth taking that question up?—That would mean a demand for students to come to Pusa merely to work for a degree in a University; I am not in favour of that.

A.2455. Supposing an M. Sc. wanted to go on to a D. Sc. degree and for that purpose proposed to undertake a problem with reference to agricultural chemistry, soil physics, or something of that kind, do you not think it would be an advantage to the Institute if you could find room for such a man to do his research?—If he applied for admission in the ordinary way and he understood quite clearly that there was no hope of gaining a post in Government service, he would probably be accepted.

A.2456. Yes, I mean that. It would perhaps help the Institute if you had one or two of that kind of men coming forward?—Yes; but as it is nobody applies unless he wants a Government post; that is the sole aim.

A.2457. *Professor Gangulee*: Have you visited any well-known European research institute?—Yes, I have seen two or three.

A.2458. In England?—Yes.

A.2459. And in Europe?—No, I have not been outside England; as a matter of fact, I was 15 years in India without getting home except for 3 months, so that I have not had much opportunity of visiting places abroad.

A.2460. How would Pusa Institute compare with the Institutes you have visited?—Very favourably I think.

A.2461. In matters of equipment, staff, accommodation and so on?—Yes.

A.2462. What are the fundamental conditions do you think that would go to establish the reputation of a research institute?—Your question is too general to answer.

A.2463. Just answer generally?—I cannot answer generally a question of that type; it would take a book to answer.

A.2464. You can enumerate the chief conditions?—I am afraid I cannot.

A.2465. Would you say that you have succeeded in developing the scientific spirit and atmosphere here?—I think so.

A.2466. Could you tell us exactly the function of the Pusa Council?—The function of the Pusa Council is to consider proposals for research put forward, to deal with publications put before it and to decide whether they are fit for publication or not; it acts as an editing body. Its functions practically end there unless requested specifically by the Director to deal with any specific point.

A.2467. *Sir James MacKenna*: Is not there a set of rules for the Pusa Council laid down by the Government of India?—Yes.

A.2468. Could you submit a copy to the Secretaries?—I will supply a copy.

A.2469. *Professor Gangulee*: *Sir Thomas Middleton* made a reference to your administrative duties; do you consider that your administrative duties as Joint Director act as a handicap to your own research work?—To my personal research work yes, but not to the initiation of research work.

A.2470. I am referring to your own work?—They certainly have; if you take 3 hours off a man's day, you lose so much research work.

A.2471. But you have time to supervise the work of your Assistants?—Yes, but I may point out that during the last three years I have only been in charge of my own section for about 9 months.

A.2472. Could you tell the Commission the nature of the work in which your Assistants have been engaged? Are they doing routine duties?—The laboratory must carry out the analytical work demanded by the other sections; that is its primary duty; that is necessary if the work of the Institute is to be carried on effectively. After that the whole of the time is available for research work.

A.2473. And in your opinion your Assistants do have sufficient time for their own research work?—I think the volume of work put out by my Assistants shows they have the time. I will admit that at certain times of the year their research work has to drop until the routine work has been passed through.

A.2474. Do these Assistants work chiefly on problems suggested by you or on problems that they themselves want to tackle?—I encourage any Assistant to put forward any suggestions for research, and if I am satisfied of the feasibility of them, I am prepared to give any assistance within my power.

A.2475. Therefore these young research workers do receive the required encouragement from the departments?—So far as I am concerned they do, and, what is more, in later years I have made a practice of not permitting my name to appear on the publications; they are published under the name of the Assistant who is responsible for the main work.

A.2476. Do you occasionally discuss with your Assistants the drift and nature of the problems?—When they have got their results to a point at which they feel they can discuss them with me, they are perfectly at liberty to approach me at any moment on the subject.

A.2477. Turning to the general agricultural question, has there been a systematic survey of the nature of the problems that require to be tackled relating to agricultural chemistry and bio-chemistry?—No, I think that depends on what arises in the Provinces; it depends on the activities of the provincial departments mainly; the conditions and the problems vary from Province to Province.

A.2478. But I am referring to the fundamental questions?—I do not understand what you mean by fundamental questions.

A.2479. For instance; the movement of soil nitrates is a fundamental question?—That is only feasible in a station like Pusa where we have a soil of unlimited depth; you could not carry on an investigation like that in a station like Coimbatore where you have a rock subsoil.

A.2480. I follow that, but I wanted to know the number of problems like that of the movement of nitrates which you can suggest should be dealt with by the Imperial Institute?—I cannot do it orally; I am prepared to give a statement to the Commission if they require it.

A.2481. I want to get, if I may, from you, a systematic survey of the agricultural chemical problems that could be undertaken in a central institution of this kind, without taking into consideration what might be done by the Provinces?—No such survey has been made; it has been left to the initiative of the Head of the Section.

A.2482. Is there any continuity of research? When you undertake a problem, do you see it through?—Yes, to the point of either discarding it, or publishing one's ideas.

A.2483. Coming to a positive or negative conclusion?—Yes.

A.2484. May I refer you to Dr. Leather's work on the water requirements of crops, which is to my mind very important. Has that work been followed up?—Not since I took charge.

A.2485. So that that work stopped where Dr. Leather left it?—Exactly.

A.2486. You attach a great deal of importance to that problem?—I do, but it is not a subject which attracts my attention.

A.2487. You have now a Soil Physicist in the department. What particular problems are being undertaken by the Soil Physicist?—That officer is a fully trained officer. He does his own work independently. Apart from the administration of the section and excluding the matter of finance, he is an independent officer.

A.2488. Is it your observation that there is a serious phosphatic depletion in the Indian soil?—I have heard that put forward in many places, particularly with these calcareous soils. I do not consider that the methods of analysis are sufficient to show definitely that there is a depletion.

A.2489. Do you consider that Dyer's method would not give you exact data?—Certainly not.

A.2490. We were told in the Madras Presidency that there is a serious phosphatic depletion?—Yes, I know that myself. I can point to places where there is a serious deficiency.

A.2491. We were told the same in Bengal?—Quite probably.

A.2492. You stated a moment ago that Dyer's method of the determination of phosphorus was not satisfactory. Have you developed a method of analysis?—We have examined the method of alkaline extraction which we find very effective in regard to the calcareous soils and with the help of the provincial departments I have been able to get standardised soils of crops and manurial history and these are now being examined.

A.2493. Then do you agree that if you could develop methods with calcareous soils, it would greatly facilitate the work not only of the Institute but also of all chemists?—Possibly. But I am not very much in favour of standardisation; though, for ordinary analytical work, standardisation is probably necessary. The danger is that it may stereotype research. I am not in favour of it unless it is necessary.

A.2494. I was particularly referring to the analytical method. Now, with regard to post-graduate training you have already stated your views. Do you not think that this Institute could be developed into an Imperial Research Institute and College, considering that it has all the equipment necessary and an excellent farm and an efficient body of scientific workers?—No, the scheme I outlined would continue the research facilities which are open now but would really make Pusa a central bureau for the central department and would lead to the institution of a number of experimental stations throughout India, each devoted to a specific object.

A.2495. Would you approve of the idea of the affiliation of this Institute to a University?—Certainly not.

A.2496. If you would look at the map of Asia you will find that there are only two Imperial Institutes, one serving China, Formosa, the Phillipine Islands and Tokyo. I think that if you could develop Pusa into an Imperial College of Research it would serve India, Burma, the Straits Settlements, Siam, Ceylon, some part of Soudan, Kenya, Mauritius and Iraq?—I cannot conceive of Government entertaining a scheme of those dimensions.

A.2497. You could not envisage a time when this Institution could be developed to that status?—Not at the expense of the Government of India.

A.2498. On page 262 you make a statement that the central department can no longer exercise the same influence over the development of the Provinces as hitherto and you ascribe this tendency, I take it, to the Reforms. Am I right in thinking that things were much better before the Reforms?—They were much better in the earlier days, undoubtedly, but, as I pointed out, that was partly due to the fact that when we were recruited to the department we came in as inexperienced officers and we were only too glad to avail ourselves of the experience of the senior men at Pusa. As time went on we were dealing with our own local problems in the Provinces and we were quite capable of tackling them, so that references to Pusa gradually became less and less. At the same time, when intricate points arose which we were not able to tackle, we referred the matter to Pusa and got what we wanted. And personally, I got considerable help from Dr. Leather.

A.2499. Would you agree with me that the influence which you are referring to depends more on the scientific reputation that you are able to create and the prestige that you are able to have for the Institute?—All reputations more or less depend upon that.

A.2500. I am sorry if I have not made myself clear. The political situation created by the Devolution Rules under the Government of India Act should in no way interfere with that influence which depends on scientific reputation?—It is simply drawing the Provinces into isolated departments under a Minister. They become separate entities and there is no organisation extant

to bridge the gaps. I do not say that it is impossible to suggest a means of bridging them.

A.2501. Do you agree with me that there is scientific co-ordination between England and Germany, although these two countries are separate units politically?—I do not understand what you mean by scientific co-ordination. There is no compulsory co-ordination between the science of England and Germany; it is purely voluntary.

A.2502. But they do come in contact when they are faced with scientific problems?—That is what I meant when I said voluntary co-ordination.

A.2503. So you agree that co-ordination and co-operation are possible in India in spite of any political adjustments?—The whole of my scheme is designed from that point of view, to obtain voluntary co-operation and co-ordination.

A.2504. And you consider the line of cleavage produced by these political circumstances may be obliterated by the scheme that you have presented to us?—That is my opinion.

A.2505. Turning to another subject, would you kindly tell us the functions of the Board of Agriculture as they exist now?—They are purely advisory, as a matter of fact. The Board meets with the object of discussing outstanding problems relating to Indian agriculture and to pass resolutions for the acceptance of the authorities.

A.2506. We have been told by one of the witnesses that the proceedings are rather dull? Do you subscribe to that view?—Yes, I certainly think so. Latterly the whole business has been dominated by the subject of cattle, and that did not interest me.

A.2507. Are any scientific problems introduced at that Board?—Very few.

A.2508. Do you approve of the idea of sectional conferences?—We have had, I think, three chemical conferences, but they have been discontinued.

A.2509. Why were they discontinued?—Because we could not get a representative body of chemists together.

A.2510. I saw a number of sugar-beets in your laboratory. What possibilities are there for the introduction of sugar-beet in India?—I believe the prospects are very good in the North-West Frontier Province. In regard to Bihar the prospects depend on irrigation facilities and the attractiveness of the crop.

A.2511. And the percentage of the sucrose content is certainly a deciding factor in many cases?—The sugar-beets we grow here when matured are quite as good in quality as those grown in Europe; only we have to grow them under irrigation.

A.2512. So you consider that sugar-beet could be introduced in this country in irrigated areas?—I would not put it in that way. I would rather say that it could be grown provided it was an economic crop. But I do not know whether it is an economic crop.

A.2513. Mr. Kamat: I have read your general note with considerable interest; I should however like to clear up one or two points about your scheme. I note that you have taken a perspective of the present situation with considerable fairness and accuracy but I want you to contrast your scheme with another scheme which we have before us, namely Dr. Clouston's scheme of co-ordination. You realise that after the Reforms the Provinces have become independent units in the matter of agriculture?—Yes.

A.2514. You also realise that owing to the Lee Commission's recommendations and the principle of Indianisation certain changes will take place which you cannot unsettle?—Yes.

A.2515. And that instead of trying to unsettle the settled facts we must find a solution for co-ordination between Provinces and between the Central Government?—Yes.

A.2516. You find that the germ of the whole situation lies in creating committees something like the Indian Central Cotton Committee for the purpose

of co-ordination and research work?—Yes, the creation of an atmosphere of voluntary association.

A.2517. And you also emphasise that any co-ordination between the Central Government and Provinces must be on the basis of a purely voluntary spirit?—Certainly.

A.2518. It would be left to the Ministers to ask for assistance if they cared to ask for it and not for any advice or interference to be forced on them?—I certainly have no intention of forcing anything on them.

A.2519. Now about your scheme. Based on these considerations you proceed to say, if I understand you aright, that at the apex, attached to the Executive Councillor with the Government of India in charge of Lands, there should be a sort of Advisory Council. Is that right?—Yes.

A.2520. That this Council should be composed of 4 or 5 experts, whom you call the first member, the second member and so on?—Yes.

A.2521. And they should advise the Executive Councillor on questions like animal husbandry, crop protection and so on?—Yes.

A.2522. Where do the All-India Crop Committees come in?—You have rather begun my scheme from the wrong end. I would rather begin from the Provinces and go upwards, than from the Government of India and come downwards.

A.2523. You can begin from the bottom, if you like?—It should be just as you have in the case of the Cotton Committee. There you have a number of interests which operate throughout India; they are not confined to any one particular Province. You may even include co-operation, agricultural economics, some of the major crops, and you may even include subjects like general propaganda, and crop protection regarding the whole of India.

A.2524. I am not concerned with the number of subjects on which you want central committees; I want to know their place in the gradation and their powers as regards finance?—I do not wish to be asked any questions regarding finance in my proposals, as I cannot answer them. I have simply put forward a scheme for the formation of committees, each dealing with a fairly clearly defined field, each being supplied with funds, and each operating over the field which is defined.

A.2525. I follow that; probably I have not made my difficulty clear to you. I know the functions which you assign to these All-India crops committees, for instance, on wheat, or sugarcane, or anything else. What is the relation between these committees and the Advisory Council which you propose should be attached to the Executive Councillor with the Government of India?—Just as in the case of the Cotton Committee, you will have a number of committees each dealing with a multitude of factors. The Indian Cotton Committee does not deal with just the raising of cotton; it deals with marketing and selling and many other factors; even the economics of the cotton trade comes within its purview. So, you have a number of committees throughout India, each dealing with a multitude of subjects. Those have got to be correlated before they are of any use to the Government of India, and the function of the Board which I suggested is to do that. If you have a member dealing with economics, he will have to be in contact with the appropriate central committee or committees.

A.2526. Are the members whom you propose should be attached to the Advisory Council of the Executive Councillor that you propose to be drawn necessarily from these All-India committees, or are they to be men of general expert agricultural knowledge, independent of them? And how are the funds to be allocated to the various committees?—The members need not necessarily be drawn from the committees. As regards funds, there being control of the committees, funds would find their way down to those committees through them.

A.2527. These committees have not to sit at Delhi?—If every committee concentrates at Delhi, the result will be too large to be of any practical utility to anybody.

Dr. W. H. Harrison.

A.2528. Secondly, I should like to ask you, when you propose that the Executive Councillor should have attached to him a Council of 5 or 6 members, are they all necessarily to be officials?—No.

A.2529. Are they to be officials and non-officials?—It was not my intention that they should be officials altogether, but it was my intention that where a member had to deal with a subject requiring expert knowledge, he should be an expert in that subject.

A.2530. Taking a concrete case, therefore, Sir Muhammad Habibullah should have half a dozen non-officials attached to him to advise him on agriculture?—Not non-officials.

A.2531. Either necessarily officials or non-officials?—Yes, according to their selection.

A.2532. According to their knowledge and capability?—Yes.

A.2533. And these 6 members ought to be in a position to tender advice from the fact of their being in touch with these all-India committees on wheat, rice, paddy and other things?—Yes.

A.2534. As against your scheme, let us have Dr. Clouston's scheme, in which it is proposed to have one Central Advisory Board composed of a fairly large number of people representing the research officers at Pusa and representing territorially the Provinces also. In that scheme there is no intermediate step, such as you propose, of having 5 or 6 members in charge of animal husbandry or other subjects, who might tender advice to the Executive Councillor. Which scheme do you like better? Naturally, of course, you would like your own scheme. But have you considered Dr. Clouston's scheme, in which there is no intermediate step?—I have considered it; it is not merely a question of opinion. I am not in favour of a large body constituted in the way suggested. I cannot conceive of the Government of India devolving its administrative functions to a body of that type, susceptible to outside influences.

A.2535. In other words, you think a Central Advisory Board, called from all parts of the country throughout India, would be an unwieldy body, and not likely to advise the Executive Councillor on technical questions?—I simply look upon it as an unwieldy body for the purpose of carrying out the mechanism of the department.

A.2536. You think the mechanism or machinery would not work satisfactorily?—In my opinion it would not.

A.2537. Under your scheme, would you abolish the present Board of Agriculture entirely?—Yes.

A.2538. You think it is now an effete body, which has served its purpose?—I do not call it effete, but I think if the scheme I have propounded is accepted, there is no further need for it; the committees would take its place, and they would be far more effective than the Board of Agriculture we now have.

A.2539. Are these 5 or 6 members which you propose to attach to the Executive Member in charge of lands to be salaried men or honorary people?—Salaried, certainly. It would be a working Board.

A.2540. A working body permanently attached at the headquarters of the Government of India?—I presume so; I did not consider the point of attachment.

A.2541. *Sir Ganga Ram*: What do the post-graduate students learn in your line? I suppose they have done all the book work before they come here? Do you teach them the practical application of chemistry to agriculture?—Yes. When they come to me, I find that they have a fair amount of general book knowledge, but they are very weak in technique, that is in quantitative analysis and manipulation and I have to spend a certain amount of time teaching them laboratory methods. After that, I try to get them on to research work as soon as possible, research connected with some problem in agriculture, my endeavour being to make them, if possible, persons capable of carrying out research on their own account.

Dr. W. H. Harrison.

A.2542. Capable of becoming agriculturists themselves or simply for employment in the Agricultural Service?—If you mean as farmers, I do not train them as farmers, but I train them as research chemists.

A.2543. Are you teaching them any practical applications of chemistry to agriculture?—I am not teaching them farming at all; they come to learn agricultural chemistry, and I teach them agricultural chemistry.

A.2544. You have stated that something will transform itself in 1929; that is the year in which our politicians expect full self-government?—Personally, I am not very much interested, because I retire 2 years afterwards.

A.2545. I can read between the lines of your reply couched in cautious language, but tell me frankly, has the introduction of the Reforms furthered the cause of agriculture?—I prefer not to answer that question.

(The witness withdrew.)

Mr. J. H. WALTON, M.A., M.Sc., Imperial Agricultural Bacteriologist, Pusa.

Replies to the Questionnaire.

QUESTION 1.—RESEARCH.—(a) For the better organisation and administration of research, I would recommend the formation of an Advisory Council, consisting of representatives of the Central and Provincial Governments. This council would have the assistance of expert committees for the consideration and preparation of programmes of investigations on definite problems in connection with such subjects are cattle-breeding, fertilisers, crop improvement, dairying, etc. The composition of each committee would naturally depend on the subject of investigation and the localities in which it was proposed that work should be carried out.

The Advisory Council would need to be provided with funds for subsidising approved investigations, the programmes and estimated costs of which had been presented to it by the committees, and the work would be carried out, according to circumstances, by provincial departments or by the central department, alone or in collaboration.

The funds needed by the Advisory Council would have to be provided from central revenues, for the work carried out would be additional to that already being carried on and financed by the Central Government and by the Provinces. Such a scheme will have its full value only if all the provincial departments are willing to co-operate, and it will be to their advantage to do so. Each will be represented on the Advisory Council and on the committees for those subjects in which it is interested. No programme of work can be forced on to a Province that does not agree to it.

Regarding the immediate needs of the central department, the present system of administration at Pusa by which the Director is Agricultural Adviser to the Government of India and also has under his charge Institutes at Muktesar and Bangalore, and the Joint Director is the Head of a Section, should be amended, and the post of Director be a whole-time appointment. Nowadays the Agricultural Adviser's responsibilities tend to keep him away from Pusa for the greater part of the year, and out of touch with the work going on in the various sections, while the routine work of the Joint Director has grown to such proportions that time that might be usefully devoted to research is taken up by minor details of administration.

(b) and (c) *Dairy bacteriology.*—Dairy bacteriology is a subject the study of which is being held up both through lack of facilities and lack of skilled workers.

At Pusa there is no pasteurising or sterilising plant, and no dairy for butter and cheese-making. Investigations here have necessarily been restricted to those dealing with the production of clean milk, the basis for successful butter and cheese manufacture.

Soil fungi.—Our knowledge of the soil fungi of this country is limited to that of a few forms that are pathogenic to plants. The part played by fungi in the biological processes occurring in the soil and their influence on soil fertility needs investigation.

Soil protozoology.—There is no protozoologist in any Agricultural Department, central or provincial, and this subject is untouched.

Plant Physiology and Bio-chemistry.—The causes underlying susceptibility and immunity to disease in plants are unknown. There is urgent need of workers both on this problem and on those connected with plant nutrition.

Irrigation.—The influence of irrigation water on the biological processes taking place in the soil awaits study. Results important in their bearing on irrigation practice should be obtained from research on this problem.

Fibres.—The bacterial processes occurring in the retting of fibre plants and their influence on the quality of the fibre produced should be investigated.

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QUESTION 2.—AGRICULTURAL EDUCATION.—The only form of agricultural education of which I have experience is the post-graduate training in agricultural bacteriology at Pusa.

(i) Such training cannot be obtained anywhere else in India, and no suitable applicants for the course have been rejected on account of lack of accommodation.

(iv) The number of applicants for the course has been greater than the number of vacancies to be filled, but the qualifications of nearly all of them were far too low to justify their admission. Until the Provinces employ more bacteriologists and bacteriological assistants, I do not expect to see any increase in the number of well-qualified applicants for this course.

QUESTION 4.—ADMINISTRATION.—By the Devolution Rules under the Government of India Act, agricultural research has been made a provincial subject, and the Central Government has kept control over only the Institutes at Pusa and Muktesar, to which have been added the Dairy and Animal Husbandry Institute at Bangalore, and the farms under the Imperial Dairy Expert, and the Cane Breeding Station.

The possible effect of these rules on agricultural research does not seem to have been properly considered or realised when the rules were framed, for their result has been the establishment of Departments of Agriculture in the various Provinces, entirely independent of one another and of the central department, and with no provision for promoting co-operation, much less co-ordination. An Advisory Council such as that mentioned in the answer to Question 1, should be able to do something towards improving the present position by furthering co-operation and co-ordination amongst the several Agricultural Departments of the country.

The sectional meetings of the Board of Agriculture, the Conference of Chemists and Bacteriologists, Mycologists and Entomologists respectively, provided the only means by which scientific officers in the various Agricultural Departments could meet together and discuss subjects of common interest.

The Conference of Chemists and Bacteriologists has not met since 1921, for owing to retrenchment in Provinces, enough money has not been available to pay the travelling allowances of a sufficient number of officers to form a representative gathering.

The revival of these meetings would be beneficial, for they assist in the free interchange of ideas among the officers who attend, and thereby further efficiency and co-operation.

The Central Government already supplements the activities of the Local Governments by the work done in the institutions at present under its control namely Pusa, Muktesar, Bangalore and the Coimbatore Cane Breeding Station. It may further usefully extend its operations by promoting research in the subjects mentioned under Question 1 (b), of which that on plant physiology in particular is urgently required.

QUESTION 10.—FERTILISERS.—(a) and (c) The amount of experimental work on manuring has been far too limited. This has been due to insufficiency of facilities and of staff for the planning and carrying out of experiments on a field scale. Improved, heavier yielding varieties of crops are being introduced every year, making greater and greater demands on the supply of plant food in the soil. Now the maximum benefit cannot be derived from an improved variety if a sufficient amount of available nutrients is not supplied to the plants; moreover large tracts of land in various parts of the country are known to be deficient in phosphates. Deficiency in nitrogen is perhaps even more marked. Further experiments therefore need to be carried out on a much bigger scale than has been done before, particularly in connection with the utilisation of the natural phosphate resources of the country, and the practicability of increasing the nitrogen supply of the soil by increasing the area sown with leguminous crops and green manures.

Oral Evidence.

A.2546. *The Chairman* : Mr. Walton, you are Imperial Agricultural Bacteriologist?—Yes.

A.2547. We have your note of evidence. Do you wish to add anything to what you have written?—Nothing at all.

A.2548. How about the site at Pusa so far as your work is concerned?—I am quite satisfied with it myself. I have been here for many years now.

A.2549. I think you might give the Commission an account of your own training and past appointments?—I graduated at first from Armstrong College, Newcastle. Then I went to Cambridge and studied mathematics and science and took the agricultural diploma, after which I went to learn practical work on a farm. I was appointed Supernumerary Bacteriologist in October 1912. I was away at the War for about 4 years; I came back as Assistant Bacteriologist and was promoted to my present appointment in April last year.

A.2550. Do you wish to say anything more than you have written in your note as to the internal administration of Pusa?—No.

A.2551. I think you have heard what the previous witnesses have said in the matter of team work to deal with particular problems. Do you agree with them?—At present there is no obstacle whatever. We are all perfectly in harmony on these subjects.

A.2552. Do you personally come into contact with the Provinces at all?—Very little. There are no other Bacteriologists in the Indian Agricultural Service.

A.2553. Is not that a reason why you should come into closer contact with the Provinces?—I could only come in contact with the Chemists. I myself have been busy getting things in my own section into ship-shape order. I have been doing what I can to get into touch with the Provinces. Occasionally I am asked for information and I always supply it to the best of my power.

A.2554. Do you expect to do any touring?—A little this year. Last year I went to Bangalore, where we have the Imperial Dairy Institute, and to Karnal. I also went to Calcutta in connection with some research on the disease of *pan*.

A.2555. Is most of your work of a general nature, such as would apply to the whole of India?—Yes, I think it is.

A.2556. Although, as you just told the Commission, you do have to deal with special problems coming from particular localities?—There are special problems, but, from what I know about them in the Provinces, some of them are much alike.

A.2557. Are you in touch at all with the Imperial Dairy Expert, so far as dairy bacteriology is concerned?—Yes, I had to go down to see him and I gave lectures to the batch of students which recently passed out; there was nobody else to give the necessary instruction.

A.2558. Are you expecting any more courses?—There is a batch at present engaged, and I shall be consulting the Imperial Dairy Expert about the lectures.

A.2559. How many students are there in the present batch?—When I was at Karnal I saw 7; I do not know how many really there are, as some of them were away at that time.

A.2560. Are they coming here?—No, I should have to go to Bangalore; I did that the first year.

A.2561. What about the calibre of the men that you had in the last batch?—I was with them for a short time, and I was quite favourably impressed with the majority of them.

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A.2562. What is the scope of the bacteriological course that you have given?—I gave them a little instruction in general bacteriology, but I gave special attention to the methods of production of clean milk.

A.2563. Where does your work end and the work of the Mycologist begin with regard to soil fungi?—Soil fungi is a thing on which nothing has been done; it is one of the subjects I have mentioned requiring research.

A.2564. But to which section would it naturally belong?—That I can hardly say.

A.2565. I thought there might be an accepted classification. Do you yourself see ahead of you a great deal of work?—I can see enough to keep me well occupied for the rest of my service, and two or three men after me.

A.2566. How do you decide which problem to tackle first?—I have inherited a good many; at present I have got sufficient to keep me going. The nitrogen problem of the soils is one to which I have given special attention; there was a recommendation to that effect passed by the Board of Agriculture some 5 or 6 years ago.

A.2567. Are you in touch with the rest of the world, so far as that work is concerned?—Through publications.

A.2568. Publications only?—Yes. Of course there is not, probably, anybody with whom I can get into touch in India; some Provinces have done a little work on that subject but not much.

A.2569. I see that you boldly advocate that the Central Government should finance the Advisory Council which you suggest?—So long as the finance is found, I do not mind who does it.

We find a good many people accommodating in that respect; I will not press you on the point.

A.2570. *Sir Ganga Ram*: Can you tell us something about nitrifying bacteria?—I could hardly do it at this stage; I can explain the subject to you in my laboratory.

A.2571. That is the thing I want to know something about. The long list of other subjects that you have given has not been investigated for want of funds?—I have mentioned the subjects as calling for research.

A.2572. *Sir Thomas Middleton*: You point out that there is no work being done on soil fungi or soil protozoology?—None that I am aware of.

A.2573. You have had no opportunities of working on soil protozoa?—I do not touch that subject.

A.2574. Do you touch soil fungi at all?—I really have not been able to deal with them at all.

A.2575. Pusa has sanction, I think, for the appointment of a Bio-chemist, but that is in another section?—Yes, in another section.

A.2576. Do you, in your own work, feel the need for a Plant Physiologist?—It would be of very great advantage and help to me in my work.

A.2577. If you had a Plant Physiologist working beside you?—If there were a Plant Physiologist in this Institute.

A.2578. What previous experience have the students at the Dairy Institute had?—I really do not know about that. I only went down to give them the minimum of instruction in dairy bacteriology, to qualify them for the diploma.

A.2579. Have any of them been through an agricultural college?—I do not think any of them have been through an agricultural college.

A.2580. The course in bacteriology consists of lessons on clean milk production?—I taught them a little about the ripening of cream and so on, but it was clean milk production that I laid special stress upon.

A.2581. *Professor Gangulce*: In this list of researches that you have given, you point out: "The causes underlying susceptibility and immunity to disease in plants are unknown. There is urgent need of workers both on this

problem and on those connected with plant nutrition." On this particular item of research, are you in collaboration with the mycological section?—There is nothing done on it; this is a subject which I have mentioned to be taken up. I collaborate with the Imperial Mycologist; I see him every day and we generally have some little discussion together.

A.2582. Is it due to lack of staff?—The whole thing reduces itself down to the lack of staff.

A.2583. And you consider it is a very important point. With regard to the next item, the influence of irrigation water on the biological processes, this also could not be undertaken?—It was a matter put forward many years ago, but there has never been any staff to carry out the work.

A.2584. Are you in touch with any experiment irrigation stations where they are carrying on an investigation of that sort?—I only see the publications. When I go Home on leave, I go and have a look round.

A.2585. With regard to the retting of fibre, are you in touch with Mr. Finlow?—He has got one or two assistants who are trained in bacteriology and who have been doing the work, but they are not enough.

A.2586. In your department, there are not enough workers to carry on these items of research that you have mentioned?—There are far more subjects for research than workers able to carry on research.

A.2587. The provincial departments have no Soil Biologists?—They had one in Madras, but that post was abolished. I am in the same position here. In 1920 there was an Imperial Bacteriologist and 2 Assistant Bacteriologists; they were members of the Indian Agricultural Service. Those 3 posts were all filled up. I was one of the Assistant Bacteriologists; the other man died and his post was abolished by the Inchcape Committee. When Mr. Hutchinson retired, I succeeded him.

A.2588. And yet, from the agricultural research point of view, soil biology is a main necessity?—It is a fundamental necessity.

A.2589. Are you aware that lately the Indian Tea Association has appointed a Soil Biologist?—I have heard that they have appointed one.

A.2590. Are you in touch with him?—My attention has been drawn to the fact that they have appointed one.

A.2591. He is tackling very important problems on nitrogen; it would be very useful if you were in touch with him. With regard to education, you say that the qualifications of the applicants for the course are far too low to justify their admission. Do you mean to imply that in our Universities there is no scope for the study of biology? What are the prospects for the students taking this course?—I have said that there are no posts for the students. As a matter of fact, all the students that have gone through the course are now employed, and though they have got posts, there are no definite prospects of any posts.

A.2592. You have got a Dairy Expert?—Yes.

A.2593. He is in touch with you?—Yes.

A.2594. Constantly in touch with you?—Yes.

A.2595. You go there for the teaching work?—I have been there to teach.

A.2596. They appoint you to teach the course?—That was for the first batch, and it was an emergency arrangement; but if these courses go on, we will have to put the bacteriological course on a permanent basis.

A.2597. At the present time, you have no post-graduate students in your department?—I have one.

A.2598. Does he come from the service, or is he an independent student?—He has come here as a private student.

A.2599. What problem is he tackling?—He came knowing nothing about soil bacteriology. That is the trouble with all the students in this section; every one who comes, unless I get one who has been an assistant to an Agricultural Chemist in one of the Provinces or one who has taken a course in

Agricultural Chemistry, comes knowing absolutely nothing about quantitative analysis as used in agricultural chemistry, and he has to learn it.

A.2600. Is there continuity of research in your department? When you get hold of a problem, you see it through?—I carry it on as far as I can.

A.2601. Would you like to see this Institute developed into an Imperial College of Agriculture?—I have never considered that matter.

(The witness withdrew.)

The Commission took oral evidence of Messrs. J. Henry, C. G. Atkins and Ganga Vishnu on the 12th and 13th January 1927, for which see Volume of Evidence for Bihar and Orissa.

Thursday, January 14, 1927.

PUSA.

PRESENT :

The Marquess of LINLITHGOW, D. L. (*Chairman*).

Sir HENRY STAVELEY LAWRENCE,
K.C.S.I., I.C.S.

Sir THOMAS MIDDLETON, K.B.E.,
C.B.

Rai Bahadur Sir GANGA RAM, Kt.,
C.I.E., M.V.O.

Sir JAMES MACKENNA, Kt., C.I.E.,
I.C.S.

Mr. H. CALVERT, C.I.E., I.C.S.
Raja Sri KRISHNA CHANDRA
GAJAPATI NARAYANA DEO of
Parlakimedi.

Professor N. GANGULEE.

Dr. L. K. HYDER.

Mr. B. S. KAMAT.

Mr. J. A. MADAN, I.C.S.

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The Imperial Agricultural Department (Pusa) Association, Pusa.

Replies to the Questionnaire.

Introduction.—The Imperial Agricultural Department (Pusa) Association came into existence in June 1925. It represents scientific Assistants of Class II and subordinate services, fieldmen, settlers, artists, and the ministerial staff of the Institute. It has been formed with the object of (1) promoting co-operation and unity amongst its members, (2) securing by joint action an improvement in the amenities of service, (3) discussing questions affecting the common interests of the members and deal with them, (4) ascertaining and formulating the views of its members on all matters concerning which it is deemed expedient to communicate its views to proper authorities or to Government. Its members come from various Provinces in India.

The Association believes that as in India 71 per cent of the population depends for subsistence upon agriculture and its allied industries the improvement of agriculture and rural conditions should continue to receive paramount consideration at the hands of the Governments in India. If we but cast a glance at the agricultural backwardness of this country as revealed in its figures of yield of various crops per acre, we realise at once what a tremendous leeway has to be made before we can come into line with other agricultural countries of the world. The average yield of ginned cotton in India per acre is only 98 lbs. whereas in the United States of America, it is 150 lbs. In the case of wheat, the average yield in India is hardly 10 maunds per acre whereas in Great Britain it is 31 bushels (24 maunds) and in Canada and Australia even higher yields are reported. The yield of rice which is a staple food crop of a large proportion of population is 1,200 lbs. per acre in India whereas in Spain, Italy and Japan the yield is 2,000 lbs. per acre and over. The yield of sugarcane in Northern India is hardly over 10 tons of cane per acre whereas in Java, it is 43·2 tons and in Hawaii 45·5 tons.

These examples will suffice to show that agriculturally we are not producing as much as we should and even admitting that on account of differences in local conditions of soil and climate we may not be able to reach the higher standard prevalent in other countries, it at least gives us confidence that if well-directed and sustained efforts are made with a view to bring about a really better state of things those efforts shall not be in vain. Besides, India

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is now coming more and more in close contact with other countries of the world. Steamship communication and railway facilities have opened the door for India's produce to be placed in foreign markets at the competitive rates which now prevail in the world; we must therefore raise our produce at such an economic figure that we may not only be able to compete but also to secure a good margin of profit for our cultivators. If we do not increase our production and at the same time lower our costs per unit, the Association is afraid that in some of those commodities in which India has to compete with foreign countries in the export markets, we shall not only lose our hold with disastrous consequences to our agricultural community but also our domestic markets may be invaded by foreign producers as they have done in the case of sugar.

In these days of keen competition not to advance is to fall behind and consequently earnest efforts should continue to be made to ascertain by research, experiment and in other ways whether the existing condition of agriculture and rural economy cannot be improved.

QUESTION 1.—RESEARCH.—(a) The Association holds that the Government of India should only exercise very limited powers of intervention in those departments which are Transferred subjects in the Provinces. The Central Government should however arrange to bring about greater co-ordination. This is more necessary because there are crops which are common to more Provinces than one such as rice, wheat, tobacco, sugarcane, cotton, and a Central Government with its staff can bring the knowledge of the crop acquired in different Provinces to the notice of individual Provinces and give the requisite help when a particular Province is either deficient in staff or other facilities for research work on that subject. It will be also economical, as otherwise each Province will have to maintain a separate well paid staff and much unnecessary overlapping of work would result.

Further, there are certain fundamental problems such as determination of water requirements of crops, determination of soil temperatures, soil gases and available phosphoric acid in soils; problems in soil and dairy bacteriology and animal nutrition; manurial problems such as the economic utilisation of green manures and natural phosphates which are not likely to be taken up by the Provinces either because problems of a more pressing nature likely to give results of direct application in the near future are crying aloud for investigation or because the Provinces have not got the necessary funds to provide the requisite staff and the laboratory and other facilities.

With the growth and development of the work of the department along research and regulatory lines, it is highly essential that definite provision be made for the closer co-ordination of these activities through a central agency. Only in this way can the most effective results be obtained. Every effort should also be made to bring about a further correlation of the research and regulatory activities with those of the appropriate provincial agencies. The department has no adequate machinery at this time for attaining this object. The Association therefore thinks that a Central Advisory Council composed of the representatives of the various Departments of Agriculture in India, representatives of the Irrigation, Education and Veterinary Departments and also representatives from the agricultural classes should form the nucleus. Commercial and industrial interests should also be represented on this Council. This Advisory Council should form different sub-committees with different duties to discharge, such as agricultural science, agricultural economics, agricultural education and propaganda on the same lines as the Indian Central Cotton Committee.

This Council should have a fund of its own, built up gradually either by direct grants of money from the Central revenues or by a small cess on the agricultural products which are exported or by both. This Development Fund should be expended for purposes of Agricultural Research, Education, Research Scholarships and Travelling Fellowships. The Provinces according to their needs as in the case of cotton research, may have an adequate share. All the schemes drawn up by the Council should be submitted to the Standing Finance Committee and scrutinised by them, the final sanction resting with

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the Government of India. The idea underlying this scheme is that more frequent contact will bring all the departments into closer affinity and a sort of brotherhood will be established between the workers of the various departments. This sense of sympathy and comradeship is in the opinion of this Association the foundation on which successful organisation should rest. For further co-ordination, the Association would like to emphasise that early efforts should be made to revive the sectional conferences which only four years ago were abandoned. These conferences provide a meeting ground for all the research workers and by the exchange of thoughts and ideas considerably stimulate research spirit. It would be worth while to suggest that the sitting of these conferences should be held immediately after the session of the Indian Science Congress and if possible at the place where that Congress has met. The reason for emphasising the point is obvious. The opportunities thus afforded will widen the outlook of the research workers of the Agricultural Departments by their coming in contact with leaders of thought and culture in the domain of science in India. In other countries these opportunities are afforded by the various associations which do not exist in India. These meetings both in their official and social aspects have considerably contributed to the promotion of research and have therefore been organised year after year, but unfortunately in India this aspect of the organisation of research has not been properly appreciated.

The Association urges that the organisation of these sectional meetings should be taken up by the Central Advisory Council.

Publications.—The delay in publication of the results obtained by research workers in the various Departments of Agriculture in India hampers to a great extent the progress of research. Further, before accepting the results for publication, the Association thinks it proper that they should first be examined by a Board of Editors—a body under the Central Advisory Council and appointed by them. In the case of various journals in England and America the Editorial Board consists of persons from all parts of the world who are pre-eminent authorities on the subjects the journal deals with. The advantage of this system over the existing one in India is that proper scrutiny and valuation of the papers is made, suggestions for improvement from authorities are forthcoming and these substantially improve the quality of the work published.

Library.—The Pusa Library which is the best of its kind in India leaves ample room for improvement. If it is made as comprehensive as possible, the needs of the Provinces can very well be served by this Central Library. The cataloguing system should be more elaborate so as to enable research workers to find out the references at one place in the card cabinet without having to search out amongst the papers in the cupboards. The system of cataloguing as has been resorted to by the United States Department of Agriculture for their own use as well as for the States should also be attempted here so as to enable the research workers of the various departments to be in touch with the progress of knowledge.

Post-Graduate Training.—Assuming that the Pusa Institute will be converted into a temple of research and higher training an improvement in the post-graduate training imparted here is called for. Under the present conditions the students coming here for training have no other attractions than training in research as the Government do not promise or guarantee appointments. If in addition to this inducement, another attraction on the following lines be introduced, the Association thinks that the popularity of this Institute will be greatly enhanced and men of the right type and calibre will be forthcoming. This Institute should be affiliated to some of the leading Indian Universities to enable these scholars to obtain a degree of Ph.D. or D.Sc. on the merit of a thesis after completion of 2 years' research work. Provision should also be made to send some of the selected students to foreign countries for additional training and experience.

Recruitment.—The number of recruits will thus largely depend upon the number of scholars available in this Institute. The recommendations of the Lee Commission which are being acted upon by the Government in so far as

the policy of recruitment in India is concerned will lead to the appointment of a large number of Indians to the Superior Agricultural Services. Assuming that the students who have undergone post-graduate training at Pusa will offer an extensive field for choice of candidates, the Association considers that the case of subordinate services should also receive consideration. The Association therefore recommends that a fair proportion of the appointments in the higher service should also be made from deserving candidates from the lower group. Such promotions will make the department more efficient by attracting capable men and utilising their extensive experience. As a rule the highest position in services should rather be earned gradually than attained at once as in other countries except in special cases. On their promotion they may be sent abroad if necessary.

Agricultural Organiser's Services.—The Association is of opinion that paucity of knowledge regarding the indigenous theory, traditional methods and the existing conditions of agriculture and its problems is a great setback to any kind of progress. The agricultural classes are generally illiterate and meet with problems, the existence or importance of which they are unable to recognise but real progress depends on their solution. Until therefore a systematic survey of their problems is made for them, the amount of labour and money spent on unsystematised research will not do much good to the country.

In order to fulfil this object an Agricultural Organiser's Service may be instituted. These officers will be men of the same Province in which they serve and along with this work should be charged with propaganda and actual field demonstrations on the cultivator's lands. These men will report quarterly to their respective Heads of departments who after allocating the various problems to various officers for solution will report to the Central Advisory Council who will take all necessary steps for the solution of the remaining problems which the Province could not undertake either for want of efficient men or for other facilities such as funds or laboratory provision. If in this way a systematic survey is made of the problems a system of research will be built up on a more satisfactory basis.

(b) *Field and Laboratory Facilities.*—The laboratories at present in existence have ample accommodation and are efficiently equipped. But if we compare the output of the Rothamsted Experiment Station with the work turned out at Pusa we suffer in comparison. The reason for this is either want of skilled workers, or deficient organisation.

Slight alterations or modifications in the laboratory equipment and field arrangements as may be necessary according as new investigations are taken up, can be carried out at no great expense.

Skilled workers.—The Association is inclined to think that the right type of men has been wanting in the department. If one glances at the past history of this department, it will be found that research has been taken up in a very unsystematic way. In all research on crop production, crop nutrition, etc., soil plays the most important part, climate having its own share to contribute. But unfortunately soil survey has been ignored and still hangs large before the research workers.

Other problems such as those of plant physiology, plant pathology which are dealt with under (c) have also not been taken up either for want of skilled workers or for financial reasons.

Handicaps.—(1) *Standardisation of methods.*—An extensive series of analyses has been carried out by the Central as well as Provincial Agricultural Departments on soils, manures, food and feeding stuffs, etc., but either for lack of co-ordination due to deficient organisation or for want of skilled workers, the analyses have not yet been corrected and standardised. Standardisation of methods is of great value to research workers inasmuch as it helps to find out the accuracy of the results obtained by them through comparison and save a great deal of preliminary spade work.

(2) *Lack of knowledge of cultivator's problems.*—The lack of knowledge of the various problems confronted by the agriculturists in the course of their

actual field work is also an impediment to the systematic investigation on scientific lines. Agricultural experts who are recruited from abroad are sometimes inclined to transplant the methods obtaining in their country without modifying them according to the local conditions. The improvement attempted hitherto in cattle-breeding by crossing the country cows with imported bulls is an instance in point. In the case of agricultural implements too, foreign implements which are constructed to suit the conditions of their soil, etc., used to be recommended in early days for use in India without making adequate allowance for the financial limits of the agricultural classes and also the practicability of their use in the fields. To give an example: the Inversion Plough was introduced in the Central Provinces and was found too heavy for a pair of bullocks. This plough was subsequently modified and can now be had at about half the original cost while it has been equally serviceable.

(3) *The language difficulty.*—The language difficulty in the case of European experts and the official position of the experts furnish another set of handicaps. The experts cannot very often get into close touch with cultivators to study the actual practice of agriculture for the improvement of which they are primarily intended and have not infrequently to depend upon their subordinates for collecting first hand information.

(4) *Touring facilities.*—Touring facilities should be more extensively given. The study of local conditions relating to a particular problem undertaken by an Assistant makes this all the more necessary.

(5) *Lack of industrial facilities for investigation.*—There are certain investigations which are undertaken in the laboratory and which on account of their economic value can be expanded commercially. The lack of facilities for this kind of investigation further leaves the research worker at a stage where no other commercial country would allow him to stop.

(6) *Lack of comradeship in the laboratory.*—The existing distinction between the Imperial, Provincial and Subordinate Services tends to produce a harmful effect on the working of the departments. The marked difference in pay, prospects and status of these services constituted and officered as they are at present, requires to some extent a readjustment as these differences would ordinarily create an artificial sense of superiority in the members of the higher branches and thereby very often prevent the feeling of comradeship amongst scientific workers which is highly desirable but which is under existing differences hardly attainable.

(c) The Association is of opinion that adequate attention can be usefully directed to the following lines of research:—(1) soil survey of typical tracts, (2) utilisation of natural phosphates, such as Bihar apatites and Trichinopoly nodules and bones for manurial purpose, (3) value of different natural and artificial manures in different types of soil, (4) food value of grains, pulses, vegetables, fruits for human nutrition, investigation into deficiency diseases, (5) standardisation of analytical methods of soil and manurial studies, (6) problems in soil and dairy bacteriology, (7) manufacture of manures and milk products, such as, casein, milk powder, and other agricultural products, e.g., egg powder, (8) reclamation of acid and alkali soils, (9) problems in soil physics, (10) problems in plant physiology; plant pathology; seed testing, (11) statistical studies of crop and weather for forecasting purposes in different Provinces, (12) dry farming conditions, (13) agricultural technology and chemical engineering, (14) horticulture and fruit preservation.

QUESTION 2.—AGRICULTURAL EDUCATION.—(i) The Association as it is constituted of members representing all the Provinces in India is in a position to say that the institutions for imparting agricultural education are comparatively few and the number of teachers also proportionately small. There is one agricultural college in each of all the Provinces except Bengal, Bihar, and Assam and that is sufficient for the purpose that these colleges are serving at present.

There is only one institute, viz., the Pusa Agricultural Research Institute which admits students for post-graduate studies. In the colleges as well as the Pusa Agricultural Research Institute the supply of teachers is sufficient.

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(ii) In every Province in India there is room for extension of teaching facilities for agriculture in schools as opposed to agricultural colleges but agricultural education of the right type in accordance with the requirements of the agricultural classes and with reference to particular local conditions should be imparted.

(iii) Teachers if drawn from the agricultural classes or from those who have gone through an agricultural course will be better able to impart education to their pupils according to their needs, with which they are already conversant.

(iv) For reasons stated in (ii) above, the attendance even in existing primary schools is far from satisfactory. Primary education should be free. Agricultural classes can hardly afford to pay the school fees for the education of their children. For grown up children of an age above 10, arrangements should be made to impart instruction in the slack season. At this age they are useful in day time on their father's lands and they cannot attend day schools, in the busy season. First, education should be given on the lines of elementary reading, writing and arithmetic, and then a general training in agricultural methods and operations supplemented by facilities for vocational training in weaving, spinning, carpentry, smithy, and clay-modelling. The product of their labour should be sold and a portion of the profit given to the boys. Training in agriculture should be made attractive by teaching the boys how to solve the agricultural problems of the locality. This will make them useful on their own lands and induce them to apply improved methods of agricultural operations. Education of such practical nature in the opinion of the Association is very likely to stimulate a demand for instruction in rural areas. The attendance at agricultural colleges is so far as we know sufficient.

(v) Under the existing conditions boys take up a study of agriculture for the purpose of employment in Government service or elsewhere. As the agriculturists cannot now maintain themselves on the profits accruing from their lands, they expect earning money outside, for which they send their boys to schools.

(vi) In places where there are stipends for boys of agricultural classes, agriculturist's sons attend schools; otherwise their number is very small.

(vii) Modifications in existing courses of study in schools are earnestly needed. They have been outlined above in (iv). In the agricultural colleges that are affiliated to the Universities, changes in the course of studies are taking place owing to the pressure of public opinion.

(viii) Provision for teaching nature study, is needed for proper education. Plots given to boys should be run on an economic basis, so that boys may learn that their labour is paying, which will create confidence in them; without such arrangements practical training will be incomplete. On the farm plots attached to the schools large scale operations should be taught and how they may be made paying.

(ix) A great majority of boys who have studied agriculture in agricultural colleges are in service under Government or elsewhere and very few of them have taken to farming on their own account. Lack of capital and fragmentation of holdings contribute not a little towards absence of independent farming. A connecting link between the collegiate education and actual farming is required to give that confidence with which one can undertake farming as a business.

(x) Please refer to answers (iv) and (viii) above. Agriculture can be made attractive to middle class youths provided some capital and decent sized blocks of land in a convenient place are made available. Capital may be supplied by co-operative credit societies on long-term loans at a low rate of interest. Cultivation of small holdings if conducted on a co-operative basis, the produce being distributed to the owners according to the area owned by them and the fertility of their lands will probably assist in this direction.

They should have a training in subsidiary industries too, such as poultry-keeping, dairying, sericulture, weaving, etc.; to which they may turn seri-

ously in slack seasons and at other times they may arrange to carry them on with occasional supervision.

(xii) Agricultural classes are generally engaged in the fields at day time. Night schools and schools for limited periods in the off-season will therefore be required for their instruction. The Agricultural Organiser's Service referred to in answer to Question 1 will be conversant with the problems and difficulties of the agricultural classes. Solutions of these should be explained in these schools and demonstration given on model farms referred to in Question 1. Practical instruction of this type, the Association thinks, will be popular among adults in rural tracts.

(xiii) Suggestions for better educational facilities in rural areas have already been outlined above. Their administration should be vested in the Union Board or the panchayat supplemented by the supervision of the Education and Agricultural Departments.

The financial help should be partly rendered by the Local Board and partly by the local landlords whose tenants will be receiving instruction in these schools. Education should be free; but a portion of the profits accruing from school plots and school farms should go to the school fund; and the same principle should apply to subsidiary industries, such as carpentry, spinning, weaving, clay-modelling, etc., which will be run by the school students.

Besides answering the specific points in the Questionnaire, the Association would like to give its ideas as regards agricultural education in the following paragraphs:—

Agricultural Education, as a whole can be divided into three classes:—

(1) elementary, (2) middle or high school, (3) education in agricultural colleges including education for research.

(1) Separate agricultural schools have not proved and will not prove successful in all cases, nor is there any clear necessity for these as yet. As soon as the boys complete their elementary education, studying nothing but vernaculars, mathematics and nature study, they should be given the choice of taking agriculture and vocational training as an optional subject with English or vernaculars and mathematics only. After the completion of their middle school examination only bright students of good means, who will be in a position to go through their college education should be permitted to take up elementary physics, chemistry and botany as additional subjects, as a substitute in part for general agriculture, i.e., they will have to devote a little less time to practical agriculture than their less brilliant fellow students, who may either leave the schools or continue their education up to the Matriculation standard with more devotion to practical agriculture. This will necessitate a revision of the syllabus for the Matriculation examination. Students of such qualifications will be better practical farmers or managers of their own farms. It is from this sort of educated cultivators that one can expect rapid adoption of modern methods of cultivation. It is they who will be able to understand the principle of co-operation and form co-operative sale and purchase societies and agricultural discussion societies. They will be in a position to make use of pamphlets or other advisory publications pertaining to agriculture or sanitation.

(2) *For training the students* in high schools it will be necessary to maintain a school farm for each school or one farm for a number of schools if they happen to be at one place. There should be at least one high school with a farm when a number of schools are situated at one place, so that those students who wish to take agriculture might join that school.

The size of the school farm should be from 100 to 200 acres managed by the Agricultural Department. In fact such farms will be more useful than the demonstration farms because these will be often visited by the parents of the students.

To teach agriculture in high or middle schools teachers should be graduates of an agricultural college. They should be controlled by the Education De-

partment. These teachers in consultation with the Superintendent of farms will plan out their schemes for practical demonstrations to the students.

(3) As is the practice at present, there should be a four years' course after the Matriculation in each college of agriculture for general agricultural education, a five years' course being provided for specialisation in particular subjects. Up to four years students will go through the same course and will be qualified for the degree of B.Ag. Students wishing to specialise will have to undergo another year's training after the completion of their B.Ag. course and the successful candidates may be awarded a degree of M.Ag.

Research students with M.Ag. degree should be selected for training in agricultural research at Pusa. Here after two years training, on the submission of a thesis, they should be awarded the degree of D.Sc.

Agricultural graduates taking the B.Ag. degree will be found useful as farm managers, demonstrators and teachers. They may also be employed in the Irrigation and Revenue Departments which are closely connected with agriculture. The employees of these departments often come in contact with the cultivators, and as such they can render more help to the cultivators if they are persons of agricultural qualifications than the staff recruited as at present.

QUESTION 3.—DEMONSTRATION AND PROPAGANDA.—(a) The measures adopted by the Bombay Department of Agriculture are in the opinion of the Association the most effective ones. When the distribution of seed is made the department guarantees the grower against loss. Improvements suggested by the department are usually after a study of the local conditions, the requirements of cultivators, their means and after satisfying themselves that to adopt them would pay the cultivator. Efforts to reach the cultivators by means of leaflets in vernaculars, through agricultural associations, co-operative societies, demonstration staff, etc., are being made in some places. Both in the introduction of a new crop or varieties of crops and in tillage implements the Bombay Department has achieved a large measure of success.

(b) The demonstration of improved methods of cultivation or growing a superior variety of crop or in the use of better implements should be carried out by departmental agency on the ryot's lands to convince him that the department's methods are a decided improvement. Side by side a demonstration should be given to show the difference in results obtained by the old methods or implements. When a new variety of crop is being introduced, there should be two plots side by side and of such size that the cultivators can judge for themselves at a glance the superiority of the new variety over the local one. Arrangements should also be made whereby the ryot can get the new seed or implement without much trouble and he may be enabled to sell the produce of his superior variety at its proper price. When a new implement is introduced, some arrangement for repairs locally is also required to be made.

(c) The Association thinks that attempts should be made by the Government on the following lines to ensure success under this head. Generally the experts or scientific officers are not within easy reach of the cultivators. To improve this state of things every Union or panchayat should have one model farm run by the department. Secondly, the cultivators are as a class suspicious of any Government agricultural concern. In order to persuade them to take up improved methods earnest efforts should be made by the department to induce the landlords to open a farm on the lines of the model farms. Thirdly, the illiteracy of the cultivators is a great barrier to their grasping the true nature of the problems or of the results of scientific investigations. Demonstrators on the model farms should be made to go round the villages by turns, hold sittings after nightfall with a number of villagers, discuss with them and try to explain the value of the results obtained in the local dialects. To supplement this activity, leaflets written in a very non-technical and easy language should be circulated among the agriculturists either through the Union Board or postal agents. The demonstrators will also be required to explain leaflets to them.

QUESTION 4.—ADMINISTRATION.—(a) At present the Agricultural Departments in the Provinces are Transferred subjects in charge of Ministers. Each department works on its own lines and there is no connecting link between a department in one Province and that in another except through annual reports and other publications and by a biennial meeting of the Board of Agriculture where programmes and other important problems bearing on agriculture are discussed. We would suggest that greater facilities be provided for the workers in one Province to meet workers on the same problems in other Provinces so that experience gained in one Province may be utilised to the best advantage. In this way unless called for by varying conditions of soil and climate, duplication of work will be avoided. Conferences of selected workers from each Province in each major branch of scientific research should also be provided as these will help in promoting a better knowledge of the problems that are being tackled, the lines of investigations which are to be dropped and the reasons therefor as well as the lessons to be drawn from these failures.

(b) As agriculture is such an important basic industry, the Government of India should maintain a staff of specialists who will investigate problems which are common to more Provinces than one and which each provincial department may not be able to tackle, itself, unaided. In the Association's opinion specialists for crops like tobacco, rice, wheat, sugarcane should be entertained by the Central Government to undertake research work and to give help to any Province which may sorely be in need of it either for financial reasons or for want of proper staff and equipment. As far as possible the Provinces should be encouraged to expand their own departments and to provide for work on almost all major problems that require attention. It will however still be the case that some problems which have been relegated to the background may suddenly assume an altogether increased importance and on such occasions the local department should be able to draw upon the central department for assistance.

(c) (i) The Agricultural and Veterinary Services still require considerable expansion and the Association would consider that until at least one veterinary hospital is provided at the headquarters of each taluk and until a small agricultural farm is provided in each taluk so that the people may be familiarised with the existence of these two departments and their beneficent activities, the public will not remain satisfied.

(ii) As regards the rates charged by the railway companies, freight rates at present for manures, implements, etc., are rather high. The railway should also provide cold storage facilities for transport of milk by rail. This will enable milk to be brought to cities from distant places and also encourage the dairy industry. The goods traffic is not handled as expeditiously as in other countries and an improvement is called for in this direction also.

(iii) *Roads*.—In many parts these are either *kutchas* or not sufficiently strong to bear heavy traffic. The bridges are not strong enough and in many places they are practically useless during floods. More roads and those too metalled as far as possible are necessary, as at present a lot of unnecessary strain falls on the bullocks and carts get broken on indifferent roads. In some parts of Bihar carts are not allowed to go on the *pucca* roads except in the rains and the cultivators have to use what may by apology be only called *kutchas* roads. This state of affairs requires to be improved.

(iv) Important weather reports or meteorological observations should be within the easy reach of cultivators. The reports may be hung in village post offices or other places of public interest.

(v) Vernacular leaflets bearing on agriculture should be distributed free by post.

QUESTION 6.—AGRICULTURAL INDEBTEDNESS.—(a) (i) Among various causes that lead an agriculturist who does not believe in money savings and perhaps has only a few ornaments as a set-by to borrow money, may be mentioned:—(1) expenses connected with social and religious ceremonies, (2) lack of ready money for payment of rent and additional taxes, (3) sudden loss of cattle due to outbreaks of epidemic, (4) purchase of seeds and manures, (5) famine,

general or local, (6) thefts and accidental fires, (7) prospective improvement of his farm, *e.g.*, digging a well.

(ii) The only persons from whom the agriculturist can borrow in a great majority of cases are the moneylender or his landlord. *Taccavi* loans from Government and advances from co-operative societies are also drawn upon by agriculturists. The credit of the agriculturist depends on his land, the number of cattle, ornaments, house, and personal character. Of these, ornaments and personal credit are the assets on which the agriculturist can depend with confidence.

(iii) Among the causes that prevent him from repaying his debt are:—(1) famine due to want of rains or failure of crops caused by excessive rains, diseases or pests, (2) improvident habits, indulgence in liquor, opium, *ganja*, and the like, (3) death in the family, (4) failure of anticipated profits from an investment in improving his land, (5) unnecessary litigation.

(b) *Unproductive expenditure*.—At present the Indian agriculturist does not correctly understand his economic position and he goes on in the way his ancestors followed when the holdings were comparatively larger, by borrowing money for any and every item of expenditure without considering whether he will be able to pay it off. Unless he is made to realise the economic position in which he is placed with the small holdings at his disposal, attempts at solving the problem by insolvency court or application of Usurious Loans Acts will not eradicate the evil for even if he be once freed from the debt there is no certainty that he will not incur the debt again. That the interest should be limited to a certain rate is reasonable but to guarantee to meet the claims of the creditor in other respects in full is necessary. Otherwise it is directly helping them to get out of it by dishonesty. So long as the *mahajan*, *sowcar*, big landholder, or *bania* is the only creditor willing to lend money and the agricultural banks or co-operative credit societies are not yet fully developed, it is not desirable to curtail the credit of the cultivator.

(c) If the cultivator is required to borrow money from sources other than the co-operative credit societies or Government, it is not advisable to control his credit in any way but to make him literate so that he may understand his economic position and the nature of the transaction that he is entering into. Limiting the right of mortgage and sale or any measures safeguarding the retention of his land will result in his losing all credit in the very market where by force of circumstances he will be compelled to go, the result being that for want of capital required at the proper time he will lose much more heavily and the very object of saving him will be defeated and he will ultimately be forced to abandon his land, if not to a *sowcar*, to the Government or to his fellow agriculturists.

Opening of more co-operative societies and encouragement of agricultural banks or the establishment of Panchayat Boards at whose recommendations *taccavi* advances may be made to the needy cultivators are some of the means that are likely to prove successful in ameliorating the conditions of the agriculturists.

A long-term credit at low interest would no doubt benefit the agriculturist. Limiting the rate of interest by law but giving the creditor the same facilities of recovering the capital and interest with fairness to the cultivator as is given to Government agencies or co-operative societies may meet present requirements satisfactorily to both parties. In case of disputes either the Panchayat Board or the civil court should fix the amount due to the creditor and the advance of that sum as *taccavi* to the debtor may be made for redemption of mortgage by the order of the court or on the recommendation of the Panchayat Board. In this way the really needy cultivator will get the *taccavi*, the creditor his just dues and the transfer of land to a non-cultivator would be prevented.

QUESTION 7.—FRAGMENTATION OF HOLDINGS.—(a) The Association would welcome means to prevent the excessive sub-division of holdings. The Hindu and Mahomedan Laws of Inheritance encourage fragmentation of holdings. These laws require to be so amended that agricultural holdings should not be

sub-divided below a certain unit which may be considered sufficient to maintain a family in decent comfort. Those who are dispossessed of their share in land should get compensation in money.

(b) The obstacles in the way of consolidation are:—

- (1) The inequality of land even in each village, and
- (2) unwillingness of some to exchange their fertile land for another piece, however large, of less productive land. Land just near the village site commands more value while that at a distance considerably less. The obstacles can however be overcome if preparatory work is done in the village by educating the people in the benefits of consolidation. When two-thirds of the community agree the remaining one-third, if they are opposed to consolidation, should be compelled by law to fall in with the others in the general interests of the community.

QUESTION 8.—IRRIGATION.—The rivers in Southern India are gradually becoming silted up. The bunds are either not properly attended to or repaired in time, with the result that whenever there is a little more than ordinary flood in the river, breaches are reported causing destruction to standing crops. The feeding canals which take water from the main rivers are also kept in a neglected condition by villagers owing to lack of cohesion in villages and decay of the old panchayat system. Effective control of the irrigation branch of the Public Works Department and the Revenue Department would improve the matters to some extent. The village panchayat system should also be revived wherever possible with sufficient powers to attend to common needs of agriculturists such as looking after village tanks, etc.

In those tracts in which there is a dull season because of the absence of facilities for irrigation, every encouragement should be given to the cultivator to sink a well. Capital for this purpose should be made available to him at fairly reasonable rates with repayments extending over a sufficiently long period. This will benefit the cultivator in various ways:—

- (1) He will find scope for employment of idle labour in his family;
- (2) it will render him to some extent independent of the vagaries of the monsoons; and (3) it will enable him to grow more paying crops by intensive cultivation where formerly only inferior millets and such other crops used to be grown. Incidentally it may be mentioned that as this water has to be raised from the well with labour which will have to be paid for by himself, he will be very careful in making that water go a long way and we shall be spared the evils of excessive watering which are noticed in areas commanded by canals.

Greater facilities should be provided in this direction by developing well-boring departments in the Provinces wherever there is scope for development in this line. The work done in this direction in the United Provinces and Bombay shows us how beneficial it is.

Wherever possible, the digging of tanks or reservoirs for storing of water should be encouraged, particularly in areas of precarious rainfall. The absence of tanks is a great hardship to cattle in the hot weather. Private companies for putting up installations for pumping water from small rivers and streams should be encouraged, as much of the water in such rivers and streams remains at present unutilised.

QUESTION 9.—SOILS.—(a) (i) Indian cultivated soils are generally lacking in organic matter which when added to the soils is soon oxidised away under the climatic conditions prevailing in this country. Naturally the replacement of organic matter in such soils would renovate them and the best methods to this end should be investigated. Proper attention to drainage and a study of physico-chemical factors, would improve some soils which contain excessive moisture, e.g., clayey soils and clay loams in irrigated tracts, but in dry areas conservation of moisture in the soils is a great problem. The value of improvement of physical texture of the soil is as yet little realised. The

importance of soil surveys in this connection has been dealt with elsewhere under Question 1 (b).

(ii) Methods applied for the reclamation of alkali soils in other countries are many and varied, but they cannot be transplanted here without first ascertaining the local conditions and the way alkali soils are developed in India, as soils differ widely in character in different countries. A proper survey of these soils, existing in different tracts, will show their nature, and a fundamental research into the causes of alkalinity in the first instance followed by the physico-chemical and biological treatments for reclamation will pave the way to sure success. Work hitherto done in this direction in India has not been systematic. Much work on the factors leading to the development of alkalinity in soils has been done in other countries. A reference to this work will show the way in which efforts should be made in this direction. In India some practical results have been obtained in different Provinces, but they cannot be considered as suitable for general application.

Flooding with water and washing out the alkali has given good results in some Provinces; while in others drainage of the whole irrigated tracts instead of individual fields is a great necessity which can be met by the department in charge of irrigation channels.

Among other measures that can be suggested, addition of organic manures and gypsum to alkali soils along with drainage is likely to give good results. Treatment with sulphur composts containing sulphur-oxidised-bacteria has been suggested as likely to be of use in improving the black alkali soils by neutralising the carbonates to sulphates and also improving the physical texture of the soil allowing it to drain more freely than before.

(iii) It is necessary to maintain the surface soil and prevent it from erosion. *Bunding* the fields as is done in rice tracts would prevent erosion by floods. Railway lines are in many places responsible for retaining flood water and causing great damage. The Damodar flood in Bengal a few years back is an instance in point. Proper bridges should be erected to allow the flow of excessive water due to such causes. Roads higher in level are also responsible to some extent. To remedy this evil contour maps of places where floods are common should be drawn, and roads and railway lines constructed accordingly, making allowances for the flow of excess water when occasion arises.

Arable soils which have gone out of cultivation or uncultivated soils including alkali soils from different Provinces have been dealt with in this Institute. *Manat* soils from Travancore, abandoned coffee estate soils from Mysore and some tea soils from Assam are some of the instances; and in many cases defects have been traced to the absence of some particular biological activity due in some cases to the entire absence of the necessary organisms, and in many others due to the absence of proper physical and chemical conditions for maintaining the bacterial activity in the soil. Restoration of the proper conditions by the necessary treatment has shown improvement in the condition of the soil, the normal bacterial activity is resumed and the fertility of the soil is restored. In some of the soils examined, total absence of the nitrifying organisms was noticed while in another nitrogen fixing bacteria were wanting. Excess of alkali, deficiency in lime and absence of proper physical condition led to the absence of bacterial activity in other soils. While it is not expected, as in the instances given, that absence of biological activity will necessarily be the root cause of the trouble in all such soils, it would not be out of place to suggest that a first examination of the soils be made from this standpoint, for it may be assumed that the resumption of normal bacterial activity of a soil is a sign of its natural fertility. If a systematic survey of such uncultivated lands along with a study of their biological, chemical and physical standpoints is made, practical remedial measures to bring them under cultivation could be suggested.

Some lands which are not fit for growing ordinary crops would however be used for planting trees for fuel if for no better purpose. That the raising of such plantations on uncultivated lands is a practical proposition can be seen from the *casuarina* plantations in the coastal districts of the Bombay

Presidency. Some lands in the coastal districts have gone out of cultivation owing to the wind-blown sand covering the cultivation thickly. For such soils there is no remedy except to take precautionary measures, e.g., to plant some binding vines beforehand.

QUESTION 10.—FERTILISERS.—(a) There is ample room for expansion in the use of organic nitrogenous manures like the farm-yard manure, cattle urine, sheep folding manure, oil-cakes, fish manures, green manures, leaf mould and household refuse. Artificial manures are being used for certain paying crops like sugarcane, and tobacco, in vegetable gardening, fruit growing and on tea and coffee plantations. The use of the manures would however be limited by the needs of each district and of the particular cultivators. This subject should therefore be taken up by the Agricultural Organiser's Service who will demonstrate their use on cultivator's field and explain the reasons for the same by broadcasting pictorial pamphlets in vernaculars. Sometimes the cultivators do not use the fertilisers simply because they are not readily available and to order them in small lots is expensive on account of transportation charges. In the beginning there will be only a few people willing to use the manures in a village but their total number in the taluk, division or the district will probably be found to be considerable. In such cases district depôts managed privately should be encouraged and in the absence of any enterprising firm or co-operative society willing to undertake this business, Agricultural Departments might show the way by opening selling depôts which can also stock seeds and implements and other agricultural requirements, till such time as some private agency comes in the field.

(b) At present very few instances of fraudulent practices in manures trade have come to the notice of the public and until the trade develops much harm is not likely to be done to the agriculturist. If such a contingency, however, arises, legislation will have to be resorted to. A basis for such legislation has already been prepared by the Agricultural Chemists' First Conference held at Pusa.

(d) The use of fertilisers has been steadily increasing in tracts growing crops like sugarcane, tobacco, vegetables, plantains and coconuts and on mango plantations. Tea and coffee planters are already regularly using the fertilisers.

(e) The effect of different fertilisers has not been studied sufficiently in different types of soils met with in different Provinces. For such a study a committee on the lines suggested by the Conference of Chemists and Bacteriologists is necessary in order to consider this problem from all points of view so as to obtain complete data. When the scheme of experiments is approved by the committee the experiments may be carried out in any locality where their practical application is likely to be of use. If the cost of such experiments is met by the Central Government probably all Provincial Governments would be ready to have them in certain areas in their Provinces. Large tracts of land of a nature similar to the Gangetic alluvium and black cotton soil of the Deccan are distributed in more than one Province and it would be economical for the Central Government to so arrange the areas of experiments according to the types of soil as to suit two or three Provinces.

(f) Provision of some other cheap fuels is one of the surest means of discouraging the use of cowdung as fuel. We have already suggested the planting of trees in waste and uncultivated Government lands. The zamindars and big landholders may be induced to realise the value of raising cheap fuel in waste and uncultivated lands in their possession for the use of their tenants, if the land cultivated by them is to retain its fertility by manuring with cowdung. In ryotwari districts also the ryot may be encouraged to plant trees in waste lands, hedges, and borders of the fields and in common pasture lands.

Encouragement of wood distillation near forest area and transportation of bye-products such as charcoal would provide the fuel which is in large demand in cities like Bombay.

Installation of bye-product ovens instead of the present method of burning coal near pits for making coke in certain collieries in Bengal would also result

in a considerable saving of fuel besides yielding bye-products such as ammonia useful for agricultural purposes.

Modified domestic ovens would effect economy in the fuel burnt and also in such ovens paddy husks and sawdust could be utilised to advantage.

Dry leaves composted with cowdung and charcoal under certain conditions would also increase the supply of organic manure at the disposal of the agriculturist. This is another direction of attacking the problem inasmuch as it converts part of the other sources of fuel into manure for which purpose the cowdung is intended to be saved.

Apart from the prevention of cowdung from being used as fuel it has to be pointed out in this connection that the cultivators in certain parts of the country require to be taught better methods of preserving cowdung and cattle urine in order to be more useful for manurial purposes than at present.

QUESTION 11.—CROPS.—(a) The improvement of existing crops can be carried out by selection, hybridisation and introduction of improved varieties from abroad. It is essential to know all the varieties under cultivation in the Province and how far they are suitable. If information on all the varieties of any particular crop is thus available from the different provincial departments it would be a great advance in the knowledge of crops. With this information will naturally follow the suitability or otherwise of the crop to particular localities. Wherever the existing variety is unsuitable, certain other varieties could easily be tried; if, however, none is found suitable on account of disease or lower yield or unsuitability to the consumer a new variety will have to be raised by breeding. The introduction of new crops from outside should be carried out under one central control, which should also take measures to ensure freedom from disease and pests along with the seeds, setts or grafts imported from outside. The distribution of these should be undertaken by the Agricultural Departments in the Provinces through suitable agencies like the co-operative societies, which will advise the cultivators to make their first trials on small areas in different localities before undertaking sowing on a large scale.

(iv) Many cases of damage by wild animals are reported by cultivators all over India. Measures to ameliorate the condition consists in wild-animal-proof fencing and destruction of wild animals by killing or shooting clubs. In some cases research in the life-history of the wild animals like the pig is suggested. A professor of zoology in any of the Indian Universities may be induced to undertake such a study on a suitable grant being given by the Central Government. This method of attacking the problem would be much cheaper than engaging special experts and should be tried.

QUESTION 12.—CULTIVATION.—(i) Cultivation of soils to a greater depth than what is being done at present is very likely to give better results. Ploughing the soil more than once before sowing has been known to give better yields as the result of better tilth obtained. This can also be accomplished to a certain extent by including some deep rooted crops like *arhar* (*Cajanus indicus*) and cotton in the mixtures with cereals or crops like potatoes and ground-nut in the rotation; because in harvesting all these crops, the soil is stirred much more than in harvesting cereals or oil-seeds.

Subsoiling has proved of value in other countries and may prove useful in certain places in India; but there are not sufficient accurate experimental data to go upon.

As the cost of such methods against that of the existing ones has not been properly worked out we would advise caution before recommending them to the cultivators.

QUESTION 13.—CROP PROTECTION, INTERNAL AND EXTERNAL.—(i) Fumigation of seeds and plants and other imported articles like cotton bales likely to bring insects and fungoid diseases is being done at present at ports of entry and is likely to prove useful, but we have not yet got sufficient data to say whether they are efficient in producing the desired effect.

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(ii) The methods adopted internally for protection of crops against pests and diseases at times prove efficient while sometimes they are only partly successful. Although pests and diseases have been studied by different specialists, opinion has been expressed by others that diseases are mere symptoms of physiological trouble or some other physical factors and the fact that the measures suggested by specialists are not as specific as in the case of human diseases, lends support to the latter view. In any case general scientific opinion is veering round to the view that the real cure for the diseases and pests would be to find out disease-resisting varieties and extend their use.

While this measure of combating the diseases may be resorted to, the study of the diseases and pests need not be neglected. In fact a further intensive study is necessary in order to search for possible remedies for the more important diseases and pests. When the diseases or pests occur in large tracts, attempts of individual cultivators will not prove as effective as they would be if undertaken in co-operation by all the cultivators over the infected tract. Dissemination of knowledge regarding the pests, their life-history and methods of control and fostering a spirit of co-operation is necessary for the measures to be adopted to be crowned with success.

QUESTION 14.—IMPLEMENTS.—(a) An examination of implements used by agriculturists for their mechanical and economic efficiency by the officers of the Agricultural Departments would bring to light the exact defects of the implements that require improvement. It would be apparent to any one that the implements to be recommended to the average Indian cultivator possessing a small holding would be different from those required by the big landholder. The big landholder having large areas to cultivate in one place, would naturally require machinery designed to dispense with a large number of unskilled manual labourers. He can also afford to invest some money in costly machinery which is meant to save him part of the payment of wages. Such landholders cultivating the land on their own account are very few in India at present and the ordinary agriculturist is not in a position to go in for such costly machinery nor is his holding sufficiently large to allow an economic use of it. Hence for the present and for a long time to come there is a great necessity for improving the present implements drawn by bullocks or other animals. This improvement can be brought about by the agricultural officers finding out what is wanted for a particular implement to be effective and when this is known to offer prizes to local mechanics by asking for small models of implements including the new features desired. Thus some years back a prize of Rs. 500 for a seed drill was offered by Dr. Mann from his private funds. We do not see why a similar attempt cannot be made by the Agricultural Department whenever the necessity arises. The prizes need not be high, nor will it be necessary to have all the features in one model. The prize may be divided according to the new features introduced, but it would be possible by combining all the features of several models to prepare a new model if the Agricultural Engineer and his staff and the competing mechanics work out the problem.

(b) Such improved implements or others of a similar type obtainable from manufacturers at a price within the means of the cultivator should be demonstrated in villages for a few seasons and if they prove successful the cultivator would be naturally induced to buy them.

In the case of complicated machinery a stock of spare parts at one central place in a district would be useful.

(c) If the manufacturers seek the help of the Agricultural Department in finding out the exact requirements of the cultivators with regard to the machine they wish to manufacture, or the defects of the machine which they have already put on the markets and if this help is freely given, the manufacturers would be able to produce a more suitable machine than if they were to depend on their own resources. Arrangements for testing such machines could be made by means of competitive trials. The holding of such trials need not be expensive as the advice of the department is free, the cost of working the machines in the trials should be borne by the manu-

facturers. The holding of such trials would give the manufacturers and the officers of the department an idea as to how the different implements could be further developed.

QUESTION 15.—VETERINARY.—(a) The Association looking at this question from the agriculturist's point of view would suggest that the agriculturist, if he is to be asked to seek help, advice and encouragement, it should be from one department instead of many; hence we would urge upon the attention of the Commission the desirability of bringing as many allied subjects under one department as possible rather than divide them into water-tight compartments. There may be separate branches of an Agricultural Department but for administrative purposes they should be under one head. There appears to be no valid reason to select the branch of animal pathology or veterinary science for separation. Just as the agriculturist is likely to require the services of a plant pathologist or a plant breeder, so also he as a keeper of livestock is likely to require the services of an animal pathologist and a stock breeder and the Association sees no reason why the Veterinary Service should not be under an Agricultural Department. If both these departments are combined, an economy is likely to result in supervising staff.

(b) The agriculturist in general is hardly aware that there are veterinary dispensaries and that he can use them. Only a few people near the towns, especially the drivers of hackney carriages or *tongas* and those who keep highly priced animals go to such dispensaries for treatment where probably they have to make a payment. In the absence of the very knowledge of existence of such dispensaries the demand for expansion can hardly arise. Officers of the Agricultural Department should make these dispensaries known to the agriculturists and get the assistance of veterinary doctors to affected areas coming under their notice.

(c) Agriculturists are not making much use of the veterinary dispensaries; they seek aid from persons who know some empirical remedies. It is necessary for the Veterinary Department officers to study these indigenous remedies and how far they are likely to be effective in every-day practice. The system of indigenous medicines may not have any theory behind them but the effectiveness of the medicines themselves suggests that an enquiry into the efficacy of the indigenous drugs is called for.

(d) Insufficient number of veterinary men and dispensaries and lack of cold storage rooms for vaccines and sera at suitable centres are handicaps in dealing with contagious diseases. Legislation for segregation and disposal of diseased carcasses is advisable. There is some difficulty in securing serum when required to meet the demand. It sometimes arrives late when the necessity for it has disappeared.

(f) (1) Want of confidence on the part of the ryot in the treatment and (2) religious scruples prevent him from resorting to inoculation of his animals. The majority of ryots are also ignorant of the necessity of precautionary measures like inoculation done by the Central Veterinary Department. A certain amount of propaganda would be necessary before the ryots realise the value and necessity of inoculation and other precautionary measures.

(g) Better facilities for research in animal diseases are desirable in Provinces. There should also be central depôts for sera in each Province so that the latter will be within easy reach of the district veterinary men. Until the provincial research centres develop, the Muktesar Institute should continue its investigations and when necessary should collaborate with the provincial research institutes by giving them such help in trained men as may be required.

(i) Unless the Veterinary Department is to be separated completely from the Agricultural Department no case is made out for a superior veterinary officer with the Government of India.

QUESTION 18.—ANIMAL HUSBANDRY.—(a) The work done on breeding livestock is limited to breeding cattle only. Opinion is divided as to whether cross-breeding (introduction of foreign blood) should be resorted to or the

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indigenous breeds of animals should be developed as pure breeds or by judicious cross-breeding among different Indian breeds. Cross-breeding (country cows \times foreign bulls) has certainly given in the first generation cows giving a high yield of milk; but in the second generation these cross-bred animals have failed to give a progeny of high yielders. The cross-bred bulls have not proved strong for draught purposes. Moreover cross-bred animals are more subject to certain diseases than the country-bred animals. The cross-bred cows of the first generation are useful for the urban dairyman. The Indian cattle could be bred up into good dual purpose animals by selective breeding and judicious feeding. It may be a somewhat lengthy process but better suited to the Indian conditions. At present the agriculturist has two kinds of animals, the cow and the buffalo. It is little use substituting a cross-bred cow for the buffalo. Very little attention has been directed to breeding the buffalo as the he-buffalo is not a good draught animal; but attempts could be made to develop the buffalo in this direction.

Distribution of good breeding bulls for the use of ryots is a necessity which if supplied at a nominal cost will be greatly appreciated in certain parts of India. Breeding bulls should in the first place be supplied where none are available at present. In this connection it is better to point out to the ryots that if castration of bulls other than the breeding bull is not carried out the object of keeping breeding bulls is likely to be defeated on account of the resulting promiscuous breeding by other bulls of a bad strain and it is better to (1) restrict the distribution of breeding bulls to areas where the people are willing to carry out this measure and (2) take away the concession already granted from those who are unwilling to do so.

In disposing of the surplus stock at Government institutions, attention may be paid at least sometime to come to distribute the surplus pedigree stock to persons interested in breeding at a reasonable price so as to keep the well-bred animals for the purpose for which they are meant.

(b) At present the dairying industry as well as breeding of stock suffers from want of suitable grazing areas. Dry animals suffer comparatively more than milch cattle or working bullocks. These latter are looked after better because they are paying or useful animals while the dry animals are looked upon in the same light as other useless stock, i.e., as a burden on the slender resources of the cultivator.

Availability of cheap fodder including green succulent fodder throughout the year is the key to the breeding of livestock and dairy industry. Pastures or grazing areas in suitable localities and better transport facilities for getting fodder from localities accessible with difficulty at present are therefore considered necessary for encouraging animal husbandry.

If these two requisites, viz., cheap fodder and a pedigree bull, are supplied the agriculturists will naturally pay more attention to animal breeding and will be able to have better animals.

(c) The possibility of growing green fodder in dry months requires to be examined. Low-lying lands near rivers where irrigation is possible, require to be exploited much more than at present.

For the purpose of improving cattle, attention should therefore be first directed to increasing the supply of both green and dry fodder where it is scarce and to discovering possibilities of extension of growth of fodder in areas where intensive cultivation is carried on.

QUESTION 17.—AGRICULTURAL INDUSTRIES.—(a) The number of days that a cultivator has work in his holding varies in different parts of India. In the irrigated tracts the idle days are very few and there is no slack season as such and the extension of irrigation advocated would therefore prove effective in reducing the slack season in tracts that would be served by the canals. Facilities for digging wells in dry areas and in those parts where canals cannot be extended would have the effect of ameliorating the condition of the agriculturists. In dry unirrigated tracts the number of idle days varies from 80 to 120 in the year. The period of idle days is not always

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continuous. In the slack season the agriculturist goes as a day labourer in his village or migrates to towns for the same purpose; sometimes he effects new improvements in his field such as *bunding*; otherwise he has nothing to do. The agriculturist will have to be given education in the particular vocation recommended for him with the necessary means to purchase the outfit for starting the industry.

(b) In the dairy tracts manufacture of products such as casein, milk powder, crude lactose, condensed milk, etc., may be suggested at present where it is not possible to export whole milk to cities. Butter or *ghi* is exported to large cities like Bombay or Calcutta but the whey is not utilised and sometimes actually wasted. In the fruit and vegetable growing areas there are seasons of plenty and scarcity. In seasons of plenty, fruits and vegetables from these places are sometimes dumped in towns and cities where they do not fetch the price they would if the supply were regulated and sometimes they are sold even at a loss. Preservation of these by canning or turning them into jams, jellies or pickles and preserves by drying is to be recommended. At present the advocacy of these has been taken up by chemists and horticulturists but not in a serious manner with reference to particular tracts.

If a persistent attempt is made by forming village clubs or co-operative societies where possible, the Association is of opinion that these two industries are capable of considerable expansion and likely to find daily employment for many people in these tracts. Preservation of fish by canning, smoking or drying is another industry that can be encouraged in coastal districts where also extraction of fish oil is likely to stimulate agriculture by production of more fish manure.

In the cotton growing parts of India where home spinning of cotton and weaving used to be done by the whole family when not actually employed in fields, these occupations can be encouraged by supplying better handlooms and by arranging for sale of the produce in special shops where articles of home industry would be sold. These might be co-operative stores or institutes who might depute their men to collect from each family the work turned out by them during the whole day.

In localities where silkworm rearing caste or class already exists, sericulture can be extended as a cottage industry to provide work in slack season or at other times as well, to members of the agriculturists' family who by reason of old age or *purdah* cannot earn wages as day-labourers, but this will be successful under the following conditions:—

- (1) If the District Boards are prepared to plant mulberry trees on roadsides and let them out on nominal charges to deserving cultivators; (2) the Industries Department or co-operative societies are prepared to purchase even small lots of cocoons from the growers; (3) existence of filatures for sericulture as an independent industry in the neighbourhood; and (4) starting of more nurseries to supply disease-free eggs.

It has been found that sericulture is not likely to be taken up in earnest, in areas not hitherto known to produce silk, as people are averse to handling the worms.

In the Punjab and Kashmir where sericulture is carried on, the disease-free silkworm eggs are imported from Europe. Efforts should be made to produce locally disease-free eggs for distribution and rearing in India. This will save a large amount of expenditure which is incurred annually on the supply of imported eggs.

Eri silk culture is eminently fitted to be introduced as a cottage industry even in new areas as no life killing of the insects is needed in any of the stages and castor plant being a seed crop, a profitable use of the leaves can be made.

Lac culture also deserves encouragement not only in the districts where it is an existing industry but also in new districts where *palas* (*Butea frondosa*)

and *babul* (*Acacia arabica*) grow and favourable climatic conditions for the propagation of the lac insect exist. To popularise this industry and to demonstrate to the people economic methods of lac culture trained fieldmen from entomological sections in the Provinces should be sent as often as necessary.

(c) Bee-keeping is not at present being carried on as a regular industry. Owing to crude methods of extraction, country honey is generally very impure and therefore sells at a much cheaper rate than the imported honey.

Experiments were started in 1909 at Pusa to see if European honey bees could be successfully kept in the plains of India in modern hives. For this purpose bees were imported from England but they did not flourish. The artificial multiplication of queen bees could not be a success on account of the prevalence of bee-eaters (*Merops*). The importation of fertilised bees from Europe by post is not economical. At present importation of hives from outside India is fraught with danger on account of honey-bee-diseases which are prevalent throughout Europe. Bee-keeping on modern lines is being carried on in the hills with the indigenous species. But they yield a much smaller quantity of honey than the foreign species.

High class Hindu castes have religious objections to taking up poultry rearing. Mahomedans, Christians and low class Hindus keep poultry. Private associations are doing good work by holding shows, etc., but we believe the Agricultural Departments in the Provinces can also do useful work in this line. At present there is an absence of proper marketing facilities in villages and poultry-keepers do not reap the full benefit from this industry.

Fruit growing as a subsidiary industry is being carried on at present in the plains wherever irrigation facilities from wells or canals are available but the obstacles to further expansion of the industry in cooler parts of India and in the hills are:—(1) their great distance from the consuming centres. (2) slow transport from the hills to the railway stations, and (3) the loss of fruit in transit due to pilfering on the railways.

(d) Oil pressing factories exist in the tracts where oil-seeds are largely grown, but the market for oil and oil-cakes in India is limited. Much propaganda work is required for the better utilisation of oil-cakes internally for feeding to cattle and for manurial purposes as their export means continuous depletion of the fertility of Indian soils.

(e) Subsidiary employment can be found by encouraging industrial concerns to be located in rural areas but this is feasible in the case of those articles which are manufactured for local consumption, as otherwise their transport to places of export would add to their cost.

Further the industrial concerns located in the villages will have to be such as have to depend upon bulky stuff for their raw material such as sugarcane which cannot be transported long distances by rail because of freight charges and of deterioration in transit. Opening of more sugar factories in rural areas will provide more employment for the idle labour in the villages and also for cart traffic.

(f) There are so many occupations carried on in villages such as those of carpentry, smithy, pottery, shoe-making where an intensive study of local practices and improved methods employed in Western countries in small village establishments will enable improvements to be effected in the inefficient tools and appliances at present used in India. The outturn of these workers in Indian villages is far short of what they can do with greater facilities and in this connection the Association would recommend the establishment of such craft schools on a modest scale in each taluk, half the cost being met by the Government and other half by the taluk as a whole.

(g) The Association believes that there are more men on the land than are required for agricultural work; hence arises much of the trouble. Emigration would partly alleviate this. Making the dwellers in villages to yearn for a higher standard of life will in due course make them work more and

prevent them from wasting their hard earned money in drink, litigation and useless social expenses. This will come on with the spread of education among them and hence the Association would recommend compulsory education wherever possible.

(h) More propaganda work on the part of the Sanitary and Health Department is required to make the villagers realise the dangers from infectious diseases, to acquaint them with causes of the spread of malaria, plague, small-pox, hookworm and such other diseases. By lantern slide demonstrations and other means the causes and progress of the disease may be shown to them and how these can be prevented or kept under control by precautions on their part. The use of dirty water for drinking and bathing, washing of dirty clothing at the drinking water wells are mostly the result of ignorance on the part of the villagers as to the serious consequences which flow from them. In this connection the Association would again urge that every village should have as far as possible its own co-operative society, its own village school with a small plot attached to it and a small library. Those who have been through the school would be enabled to keep up their education. They would work more easily together in combination with a view to improve their condition and they would readily listen to the advice given by itinerant staff of the Agricultural, Veterinary, Co-operative and Sanitary Departments. Development of private associations on the lines of social service leagues will go a long way in ameliorating rural health.

QUESTION 18.—AGRICULTURAL LABOUR.—(a) The Association understands that on the continent of Europe there used to be in pre-War days a Home Colonisation Office which used to work with a view to assist emigration from a congested area to an area sparsely populated so as to bring about a normal supply of both agricultural labour and cultivation of land which used to previously remain fallow. There is room in this country for such an organisation as we have got in India tracts where the density of population is over a thousand per square mile while there are tracts like parts of the Central Provinces, Central India, Assam and Burma, where there is a real shortage of both agricultural labour and cultivators to till the soil. When inducing the rural population from a congested area to emigrate to sparsely populated area, it should be explained to them that the land proposed to be given to them will be large enough to support a family and that they will be charged 3 per cent interest on the value of the land for 60 years, at the end of which period they would own the land in fee simple as is done for the landless in Ireland.

QUESTION 20.—MARKETING.—(a) In connection with market facilities for sale of produce the Association would consider the establishment of properly conducted sale depôts to be highly desirable so that the cultivators may not have to part with their produce at any low price which may be offered to them. There should be posted upon the notice boards current market rates for that particular produce as received from important centres of trade so that the cultivators may compare the price which is being offered to them and if not satisfied with the price may keep their produce in the godown of the depôt for sale when better price is offered. These markets will be particularly of use in case of non-food crops such as cotton, ground-nut, etc.; some such system was proposed to be organised by Lord Kitchener when he was High Commissioner in Egypt where the Fellahi were to be kept informed of the prices of Egyptian cotton ruling in the Liverpool market, whereby they were to be enabled to make better terms with the purchasers of such cottons. The Association understands that much good work has been done in Berar by the institution of cotton markets and the Association would like to see the extension of such markets in other cotton growing tracts where conditions permit of their being established.

The agricultural produce when it leaves the cultivator's hands generally passes into the hands of a *mahajan* or middleman, thence into the hands of an agent of an exporting firm in Bombay, Karachi, Calcutta, etc., and finally the exporting firm transports it by sea to foreign countries. Very often the

cultivator is either in debt to the *mahajan* or has taken an advance from him or has sold his crop ahead, whereby he is unable to reap the full advantage of the fluctuation in prices brought about by the world factors. He has therefore very little inducement to grow crops pure or of better quality and hence while inducing cultivators to grow crops of improved variety or of better yielding power it is necessary to devise means whereby they may be enabled to sell their produce at its superior value.

(c) Indian produce abroad has generally a bad name for impurity, mixing up and low quality. Steps therefore should be taken to make an improvement in this matter. Some mixing up of sand, dirt, etc., takes place on the cultivator's own threshing floor where he gets his corn trodden out by bullocks and some mixing up is also inevitable in those parts where the practice of growing mixed crops is in vogue. Some mixing or adulteration must be taking place in the case of non-food crops at the hands of middlemen and other intermediaries.

The Association considers that cultivators as well as small merchants outside the main ports in India are not sufficiently acquainted with the prices of the produce ruling in other markets of the world, the fluctuations therein and the causes thereof. What is required is that each trade should have a regular service for getting telegraphic information from the important foreign markets, the condition of the crop dealt in, stocks and consumption. By combining together each trade can get for its own individual members up-to-date information at a cost which would be prohibitive for a single individual. Greater publicity should also be afforded in district towns and other important places by issuing market bulletins in vernacular either through the local newspapers or by the association of the merchants and traders themselves. As India is no longer cut off from the rest of the world and as prices are fixed for all important export crops in centres outside India, it is of the utmost importance to devise measures to keep the trade and through it the agriculturists well posted in the prices of the important commodities, because the difference between the price the cultivator gets and the price which he should have got makes all the difference to him between the success or the failure of that crop from the point of view of economic production.

(d) In the opinion of the Association it is high time that the Central Government should establish a marketing bureau on the lines of the United States, of America, (1) to gather and disseminate information concerning supply, demand, prevailing prices, (2) to promote, assist and encourage the organisation and operation of co-operative and other associations and organisations for improving relations and services among producers, distributors and consumers, (3) to foster and encourage standardising, storage and sale of agricultural products, (4) to investigate the practices and methods and any transactions of commission merchants and others who receive, solicit and handle on commission any such products and to protect and conserve the interests of the producer and the consumer, (5) to improve, broaden and extend in every practicable way distribution and sale of agricultural products and (6) to reduce the expense and cost of marketing.

QUESTION 21.—TARIFF AND SEA FREIGHTS.—So far as raw material is concerned, there is nothing to complain about the existing customs duties. Export duties are only levied on jute, which is the monopoly of Bengal, Bihar and Assam and on rice exported from Burma which occupies a considerable position in the rice trade. The tea, lac and the cotton industries impose a small cess which is intended for the benefit of the industry as such and therefore does not come within our purview.

QUESTION 22.—CO-OPERATION.—(a) In Provinces which are more advanced than others non-official agencies are being more and more interested in the progress of the co-operative movement and by affording facilities for acquiring some knowledge in the principles of co-operation through co-operative institutions and other means an increasing body of unpaid workers is being brought in. Useful work is also being done by some members of the Servants of India Society. The services of Mr. G. K. Devdhar in this connection may

be specially mentioned. In those tracts in which the rural population is very backward, the Government should do more in first preparing the ground by educating the people in the principles of co-operation and starting societies where people evince their desire to have them. In the first stages considerable assistance should be given to such societies by giving them the services of a trained secretary and by paying frequent visits to the societies to see how they are working. It is only when the department is satisfied that these societies can stand on their own legs that official assistance should be withdrawn.

(b) (ii) Co-operative purchase societies are very useful for such things as manures, seeds, and implements as the society can obtain them at cheaper rates by ordering in bulk and by being able to make cash payments. It may be mentioned that unless the members of the society have some sort of business instinct they are likely to be unsuccessful, *e.g.*, whether artificial and other manures should be purchased at a time when the prices are low and stored or whether they should be purchased just before they are required when usually the price is high.

(iii) Co-operative sale societies are more difficult to manage as they usually come into open competition with vested interests. Here also business knowledge is required as a large quantity of produce has to be dealt with and the best possible price obtained for the members. To enable co-operative sale societies to function successfully, proper facilities for marketing are essential and here we would repeat that intelligence about current market rates within the country as well as abroad should be available to them. Co-operative societies are useful in another way in that the members would not be cheated in weights and measures nor will they be obliged to sell at whatever price is offered them by the ring of brokers or middlemen or some such other intermediary. A co-operative sale society can hold its produce for a rise in the market and can thus ensure full benefit to its members. The Agricultural and Co-operative Departments should have a staff who by frequent visits will render them such assistance as may be required. The Association would welcome whatever measures the Commission recommend for the extension of this form of co-operative movement. It is inevitable that mistakes will be made; some attempts may prove failures, but in view of the great utility of this side of the co-operative activity it is desirable not to lose heart but it should spur the Co-operative Department and those who have faith in the co-operative movement to redouble their efforts and to spread its blessings among the rural population.

(vi) A society for the co-operative use of agricultural machinery would be of great assistance to sugarcane growers as they can purchase power cane crushing plants which are beyond the means of ordinary agriculturists and are highly necessary in order to extract the amount of juice which is at present wasted by the prevalent method of crushing cane by bullock-driven two-roller or three-roller mills. Such societies can also purchase costly implements, *e.g.*, those for eradicating *Kans* grass and make them available for the use of individual members.

QUESTION 23.—GENERAL EDUCATION.—(a) In the modern world to be able to read and write has become almost a necessity for any individual in any walk of life and the agriculturist cannot be an exception to the rule. To him knowledge of arithmetic is equally essential. The efficiency of an illiterate agriculturist already well trained in his occupation may not be less than that of a literate one but if he wishes to be abreast of the time he must keep himself informed of the advances that are being made. It is in this respect that the literate agriculturist scores over the illiterate one; and hence we find that those countries in which the agriculturists are literate are advancing in various directions. In his every-day dealings with the middleman we find that the agriculturist in this country is cheated in many ways by short weights and false measures. He very often does not know the price ruling in places where his produce is finally sold. He is unable to calculate therefore the fair price that he ought to get for his produce.

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It is for these considerations that the Association thinks that primary education should be made compulsory.

As regards higher education, literary education specially in its higher branches is more in fashion probably because at present there is not sufficient provision for other kinds of education available. It would be a move in the right direction if the middle school and high school education were much more varied like higher collegiate education. At present there are colleges for medicine and surgery, mechanical and civil engineering, agriculture, and for military training, but in high schools we find only one literary course without any attempt at imparting instruction in any vocation. The Association would therefore advocate the opening of technical schools in which the village industries would be dealt with and modern appliances and improved tools and improved methods of working in, say, carpentry, smithy, pottery, or leather manufacture and hand spinning and weaving be brought to the notice of boys attending middle schools so that when a boy leaves the school he will be able to set up as an independent working man instead of having to seek service on the merits of his literary ability as at present. It would be quite feasible to start one technical school on the lines suggested in each district. These technical schools can manufacture articles which will find a ready sale if they are adapted and suited to the needs of the people. Part of the money realised in this way may be credited to the account of the boys working in them so that at the end of the term the boys will have not only confidence in themselves but the money wherewith to buy the things required for starting the industries.

(b) (i) To give a varied character to the education given and to introduce the study of natural sciences along with literary subjects will turn out people better fitted to make a living and also create interest in agriculture. In order that craftsmen may be induced to follow their ancestral trade with intelligence, a training in manual arts may be introduced in suitable localities if not in all places.

(ii) Compulsory education, though desirable in rural areas, should be preceded by free primary education in villages to induce cultivators to send their sons to schools. Otherwise as a majority of them require their sons to tend to their cattle while grazing or do some light work for the household, they will be unwilling to send their sons to school as they themselves hardly appreciate the benefits of such education.

(iii) As soon as the boys attain a certain age they begin to be useful to their parents in their work. It will be a burden on the slender resources of the parents if boys are sent to schools when they cannot afford to lose the income which the boys would be able to earn and if fees have to be paid in addition there will be still less inducement. In this connection it may be pointed out that the fees in primary schools in certain parts of India specially the ryotwari districts are lower than in zamindari tracts and Provinces. The Association therefore suggests that (where the value of land has much increased since the time of permanent settlement) moral pressure be brought to bear on the zamindar to open schools for the sons of his tenants like the Indian millowners who are now beginning to do welfare work for their labourers by opening schools for their sons and giving medical aid in certain cases. As the zamindar is getting rich on account of the permanent settlement through people toiling in his fields, it is but natural to expect that he should be asked to pay a certain sum as contribution for maintaining a free primary school for his tenants' sons and for other activities likely to improve rural conditions.

QUESTION 24.—ATTRACTING CAPITAL.—(a) Agriculture by itself as carried on now is not profitable and men with capital do not invest money in it because as an industry it does not yield as much interest as is obtained in other industries. Agriculture at present is reduced to the state of industry in which the cultivator employs his daily labour to earn some days' wages during the year; and hence unless the size of one big farm or the total number of holdings is sufficiently large to be economically productive and

at the same time capable of providing a decent living, no man of capital will be attracted to agriculture. The passing of such Acts as the Usurious Loans Act and the Deccan Agriculturists' Relief Act has made the man who can lend money to the cultivators shy of investing his capital in land mortgage made even for improvements in lands, as there is in his view no surety of getting due interest and sometimes even the capital is lost. If the capitalist takes to agriculture on his own account, it is but natural that he would expect to have some if not all amenities of life that he enjoys in cities and towns, a better social organisation, the lack of which drives away people of means to towns.

(b) The financial condition of the agriculturist is certainly not such as will permit of his effecting improvement in his land. Lack of capital makes the agriculturist hesitate to borrow money for costly improvement because if the undertaking proves a failure for some reason or other or does not yield a good return, the agriculturist is burdened with unproductive debt. A short-term lease and uncertainty of tenure in zamindari lands is another factor which naturally discourages actual cultivators from effecting improvements. There is also the fear and suspicion lurking in the minds of the agriculturists that any improvement effected by them would be liable to increased land revenue. In zamindari tracts the increase in rent would be much higher. The local customs of zamindars designed to evict a tenant by increase in rent or participating in the benefits of improvement without paying for it also act as deterrents. In some cases ignorance of the fact that any improvement is possible is also responsible for non-improvement or stagnation.

Want of enthusiasm and co-operation among fellow cultivators are also partly responsible. Provision of adequate propaganda staff of agricultural organisers and demonstrations of improvements in villagers' plots are means to make the agriculturist effect improvements in his land.

The Association considers that in Northern India where the zamindari system prevails the zamindars should be made to devote a portion of the money which they derive as rent collected from the tenants in starting demonstration farms, seed stores, implements depôts, veterinary hospitals and in supplying good bulls for improving the breed of cattle. In the past when zamindars like petty kings used to protect the people by maintaining a small army of their own it was fair that they should exact the land tax from those who owed security of their lands and crops to the protection offered by them, but now they no longer fulfil the function and for the rents charged at present no substantial service, it appears, is being rendered to the tenants and this seems inequitable so long as this state of things continues. If we are to have better social organisation, panchayats or Union Boards should be encouraged wherever possible. Demonstrations of what a model village should be like may be given by establishing one such village in each taluk as it is the surest means of making the people in towns as well as in villages realise that life in villages of which the model villages are examples is worth living. Retired engineers, medical men and officers of the Agricultural Department may be induced to stay in villages by giving them certain facilities and a seat on the Union Board or panchayat. This will give an impetus to the development of model villages. In colonisation schemes also a sprinkling of such men amongst the agricultural colonists is necessary as it would thereby naturally make the people in such colonies pay more attention to health and hygiene and better transportation facilities in a way that no amount of lecturing would do.

QUESTION 25.—WELFARE OF RURAL POPULATION.—(a) The Association would consider that the improvement in the rural conditions will be to some extent accelerated if in each taluk one or two model villages are brought into being. By a model village the Association means a village which has got a hospital, a village school, a co-operative society, an agricultural association, a veterinary dispensary, a small library and a place of amusement. Such model villages should be connected by good pucca roads with headquarters of the taluk. The cultivators round about might be induced to visit these model

villages frequently. Thereby an interest will be aroused in them to improve their own village conditions and unless sanitary and social conditions in villages are made better than what they are at present the present drift to the towns will continue. In the past when the mode of life was practically the same for rich and poor alike, the villages were more homogeneous but now that towns and cities provide so many facilities and comforts of life, those who have wealth are tempted to migrate more and more to cities where they can command the highest class of education for their sons and daughters and can have them settled in various avocations of life. A great field is opened out in the commercial and industrial lines in cities and human instinct being what it is, everybody thinks that he can better his prospects where any one whom he knew has actually done so.

(b) The Association is in favour of Government conducting economic surveys in typical villages with a view to ascertain the economic position of the cultivators. In this connection the Association is in general agreement with the views of Mr. Burnett Hurst in the Economic Enquiry Committee.

QUESTION 26.—STATISTICS.—(a) At present the departments in the Provinces issue Season and Crop Reports and Forecasts of principal crops. It would be desirable to have these as widely advertised as possible in the mofussil also so that an idea may be formed of the stocks likely to be available in the coming season and the prices may be regulated more on such established information. As regards estimates of crop yield these are based on the area under a crop, the average yield per acre and the seasonal factor. As regards area figures these are fairly accurate in ryotwari tracts and in those places where land records are properly maintained. In certain zamindari tracts in Madras and in the permanently settled tracts in Bengal and Bihar they are capable of improvement on similar lines as ryotwari tracts. As regards the average yield per acre the Agricultural Department should conduct more crop cutting experiments in different types of soil so that a fairly accurate figure may be arrived at. As regards the seasonal factor it would be better to give in percentage, the weather conditions influencing growth of the crops as compared with the average of the preceding ten years instead of saying that it is ten or twelve annas of the normal crop as nobody is sure of what quantity is exactly meant by a normal crop. It is desirable that in each Province there should be a bureau of statistics attached to the Agricultural Department with a good staff at the headquarters and with itinerant assistants who would go round in the district checking the returns submitted by the revenue authorities and educating them when necessary as regards the value of accurate figures. In advanced tracts some non-officials living in villages and in touch with agriculture may also be tried as reporters for the purpose of forecasts as an additional check on the returns, submitted by the Revenue Department.

**Mr. N. V. JOSHI, M.Sc., L.Ag., Representative of the Imperial
Agricultural Department (Pusa) Association, Pusa.**

Oral Evidence.

A.2602. *The Chairman:* Mr. Joshi, you are Secretary of the Pusa Association of the Imperial Agricultural Department; is that the title?—Yes. At present I am officiating for the Secretary, who has gone on leave.

A.2603. We have in our hands the note of the evidence that you wish to give. Have you any further statements that you would like to make at this stage, or shall I ask you one or two questions?—I would only like to say this, that we have in several meetings of the Association discussed all the points that we have noted down in our memorandum. The memorandum was drawn up by a committee appointed for the purpose and it has been read out and discussed in the meetings of the Association. This memorandum, therefore, represents the collective opinion of the Association.

A.2604. How long has the Association been in existence?—For nearly two years.

A.2605. Your note is very full, and I think, your meaning is perfectly plain on the face of it, but there are one or two points I should like to ask you about. Would you turn to page 293? You are talking there about publications and you say, "The delay in publication of the results obtained by research workers in the various Departments of Agriculture in India hampers to a great extent the progress of research." To what exactly do you attribute that delay?—The delay occurs in getting the results printed. They have to be circulated to several members of the staff who are sometimes on tour. We have got to wait for them for one or two months, and the time taken in printing is also considerable.

A.2606. You would probably agree that a certain amount of delay on occasions is less disadvantageous than would be the premature publication of unsound results or anything of that sort?—That is true in some cases, but in other cases it is a disadvantage, because the results that we have already obtained are sometimes printed in other countries before our publication is out.

A.2607. So that you think that a Board of Editors might take the responsibility? Is that the point?—If the printing could be done a little quicker, it would be a great advantage.

A.2608. Is it the Head of the section concerned who goes away on tour or who? I am not sure that I have understood you?—After the Head of the section has passed it, it has got to be circulated.

A.2609. To other Heads of sections?—Yes, and they are sometimes on tour.

A.2610. I see you are not satisfied with the indexing in the library?—That is so.

A.2611. Has there been any improvement in that respect of late?—We have not got the index of subjects or of the journals that is to be found in the United States of America.

A.2612. Is it the experience of members that considerable delay occurs in searching for particular books?—Yes.

A.2613. Turning to page 293, have you anything more to say about post-graduate training than what is set down therein? Can you suggest any means by which this course might be made more attractive?—After putting down our views in the memorandum, I have been told that some of the Heads of sections are quite willing to take students for the higher degree given by the Indian Universities provided there are seats available. If this definition of their attitude is made clear when advertisement is made for admitting students in the Institute, perhaps it would attract more applications.

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A.2614. I want to be certain what it is that you mean when on page 294 you suggest the institution of an Agricultural Organisers' Service? Are you thinking there of a series of organisers in Provincial Services?—We are talking of an Agricultural Organisers' Service in the Provinces.

A.2615. What exactly do you mean on page 295 when you speak about the lack of comradeship in the laboratory?—We mean that at present we have got three different services in this Institute and there is a large difference in the pay and prospects of these services. This creates a feeling among the different members of the staff which leads to the members of one service feeling rather diffident about approaching the members of the higher service simply because they think that the administrative differences that exist would prevent them from consulting them in the same manner as they would have consulted men in the same service or men who had risen from the same service.

A.2616. I understand what you hold to be the circumstances that bring about this lack of comradeship, but in what fashion does it manifest itself? Is it a question of subordinates not being taken into the confidence of superiors about particular experiments or what? Is that one phase of the matter?—The Heads of sections, for example, come in contact with each other and meet each other at various times and the scheme for experiments that they lay down is perhaps passed on to the subordinates in the various aspects. The subordinates do not know the scheme as a whole and therefore they do not take the same interest as the Heads of sections do or which they would take if they were present at the time of consultation. Hence their interest in carrying out the experiments is not the same as it would have been if they were present when the original experiments were agreed on.

A.2617. I was a little surprised to notice that on page 297 in suggesting that farms should be attached to certain educational establishments, you name 100 to 200 acres. Is not that rather a large farm?—This farm is supposed to be attached to the high school of a district where the number of students is expected to be sufficiently large.

A.2618. I am sure you and your associates appreciate the difficulty of managing a plot of that size. It becomes a very big unit and requires skilled management?—We would like to have a trained agricultural graduate for that purpose.

A.2619. You suggest that the Agricultural Department itself should manage the farm; is that the idea?—No, the trained agricultural graduate should be in the service of the Education Department.

A.2620. I am not misinterpreting your words. On page 297 you are talking about training students in high schools and you say that it will be necessary to maintain a farm of 100 to 200 acres managed by the Agricultural Department?—I am afraid in the hurry of getting up this memorandum, this mistake has occurred. It is a mistake to say that it should be managed by the Agricultural Department as such; it should be managed by agricultural graduates.

A.2621. On page 298, you develop your ideas for the extension of the demonstration and propaganda services, and I see that you are attracted by the suggestion that the grouping of panchayats should be encouraged by way of stimulating self-help?—Yes.

A.2622. Do you know of any actual experiment upon which this suggestion has been founded?—There has been some movement in these panchayats and Union Boards in Bengal to have this sort of thing done. In other Provinces there are not many panchayats encouraged like that as yet. The panchayats are not formed, or where they are formed they have not had sufficient time. We think that these panchayats, if they are formed, will take this up.

A.2623. On page 306, you are dealing with veterinary problems. I take it you have no representatives of veterinary science on your Association?—We have.

A.2624. Do they subscribe to the view that it might be well to make further investigations into indigenous remedies?—Yes, they do.

A.2625. On page 314, I have studied your suggestions for the creation of model villages for propaganda purposes. I do not quite gather from your

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scheme how these works are to be financed. Where do you suggest the money should come from for the creation of a model village in each taluk?—In the first instance, for the one or two model villages that may be created in a Presidency, this money would come from Government funds. After seeing the model village and its advantages, we think the people from different villages would come forward to get their villages organised, and they would probably be willing to pay the necessary expenses required to remodel or reconstruct their villages.

A.2626. *Sir Henry Lawrence*: Were you in the Bombay Department of Agriculture at one time?—Yes, I was there for 2 years.

A.2627. Do you come from the Poona Agricultural College?—I was trained in the agricultural branch of the Science College. The Poona Agricultural College was not started when I entered college, but I was demonstrator there, under Dr. Mann, for 2 years in chemistry and geology.

A.2628. In the Department of Agriculture at Bombay?—Yes.

A.2629. And then you were transferred here?—Yes.

A.2630. What work are you doing now?—I am First Assistant to the Imperial Bacteriologist.

A.2631. On page 298, I see that you consider that the Bombay system is superior in certain matters. On the question of demonstrations and propaganda, you say, "The measures adopted by the Bombay Department of Agriculture are in the opinion of the Association the most effective ones." Is that your own view, or the view of the whole Association?—It is the view of the whole Association as well as my own view.

A.2632. And you think that when the distribution of seed is made, the department should guarantee the grower against loss?—Yes.

A.2633. Is that being done in any other part of India?—The members of the Association, who come from different parts of India, have not pointed out that it is being done in other Provinces, and in the reports issued by the departments we have not seen any mention made of that system.

A.2634. You think that would be the most effective method; is that based on the experience in Bombay?—We think that guaranteeing the grower against loss not only in cases of seed but in any kind of experiment would create confidence in the grower, and he would be more willing to carry out the experiment than if he had no such security.

A.2635. Do you know whether in fact the Bombay Department has ever had to make good any losses?—We do not think that any substantial loss has occurred except in one or two cases.

A.2636. No claims for losses have been made against the department?—No, except in one or two cases.

A.2637. I suppose it is possible that claims might be made on very unsubstantial grounds, which it would be very difficult to determine?—Of course, in theory, it is quite possible to make such claims, but so far as the practical results of this guaranteeing are known we are not sure whether such claims would be made on flimsy grounds.

A.2638. I gather that you consider that the service which you represent has not got sufficient openings in the matter of prospects and pay. Have you worked out any scheme of what you think would be a suitable scale of pay for yourself and your companions?—We could supply it to the Commission if it is required. We did not like to put it in, because in a general enquiry of this kind we did not wish to put forward our claims as such, as it might be thought we were actuated by selfish motives in representing the claims of our service to a Commission of this kind instead of representing them to Government.

A.2639. Have you made any such claims to Government at any time; have you made any representations on the matter?—We have not yet made one, but we have got a scheme in hand, and we are going to represent the matter.

A.2640. Could you send it in to the Secretary of the Commission for information?—As soon as it is ready I will.

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A.2641. When is it likely to be ready?—In a week or a fortnight.

A.2642. That would be ample time. What is the main criticism you have to make? The starting pay is not sufficient, or the pay to which you can rise is not sufficient, or what?—The starting pay is not altogether sufficient. Then after having risen to the maximum pay, the Assistants in the Subordinate Service are not satisfied to remain permanently on that pay. There is no prospect of promotion to the higher service; the posts are limited, and they think that an intermediate grade of pay is necessary for workers who have shown aptitude for research and whose work is appreciated by the department.

A.2643. Are you, in fact, worse off than the officers who remain in the provincial departments?—The Class II officers and scientific Assistants are certainly, in our opinion, worse off than the officers of similar grade in some of the provincial departments.

A.2644. Is there any opening for you to transfer back to provincial department?—The provincial departments are unwilling to take people who have risen in the service at Pusa, simply because the claims of the people serving there are handicapped thereby. They would not like to take men from Pusa except on a lower grade of pay to start with; they would like to promote their own men.

A.2645. Do you wish to see the system of mutual transfer made possible, so that men might be brought from the provincial departments to Pusa and men from Pusa sent back to the provincial departments; is that in the scheme of your Association?—We have not definitely suggested it, but we have discussed it, and if the different Governments are willing to accept that, it would be advisable to do it. But, as we are concerned with the Government of India and we are going to send the scheme to the Government of India, we have not thought it fit to bring the matter of the interchange of officers by the Provincial Governments to the notice of the Government of India, because we have not got the views of the Provincial Governments as to how far they would appreciate it or be willing to give effect to it.

A.2646. You are not reluctant to leave the secure position of service under the Government of India for the more precarious position of service under Provincial Governments? Is that in your mind?—That is not the point; we would be willing to go to the Provinces, but we are not sure that the provincial men would be willing to come here.

A.2647. A system of mutual transfer might be advantageous to both sides, to the Provincial Governments and to Pusa?—I had a discussion about it with Dr. Mann, and he was in favour of it, but we thought it would take rather too long for the Government of India and the Provincial Governments to come to an understanding on this point; it is a question of the various Governments concerned approving of this course, however much we may like it.

When it is a question of having a permanent system, a little delay in considering proposals is not a serious matter; that should not debar you from putting forward the scheme which you think is the best possible for Pusa and the Provincial Departments of Agriculture. I leave it to you to consider.

A.2648. *Sir Ganga Ram*: You are in Government service?—Yes, I am.

A.2649. Is this Association recognised by Government?—Yes.

A.2650. It consists of all the Indian members of the staff here?—It consists of Class II officers, scientific Assistants, fieldmen and other men in subordinate grades.

A.2651. What is Class II?—They are equivalent to the Provincial Service men. The Indian or European members of the Imperial Service are not members of this Association.

A.2652. Is what you have represented here your personal opinion or the opinion of the Association?—This is the opinion of the Association.

A.2653. You placed all these criticisms before your Association before you sent them to us?—Yes. The report of the committee was placed before the general meeting.

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A.2654. Have you any personal experience of other Provinces?—Yes, by way of going to the different Provinces and enquiring.

A.2655. You have made some criticisms of Northern India. Have you ever been to Northern India?—Not personally, but we have other members who have been to Northern India.

A.2656. You say on page 314 that the Northern India zamindars should be made to devote a portion of the money to certain objects. How? Do you mean by legislation?—By moral pressure.

A.2657. I do not understand the meaning of moral pressure. What do you mean by that?—By creating public opinion.

A.2658. By starting a political paper?—Something of that sort, if nothing else would make them pay; just as the millowners of Bombay, for example, are doing a certain amount of welfare work for their labourers.

A.2659. Are they doing any welfare work for their labourers? I thought it was the other way. However, what I want to ask you is whether you represent here your own views or whether any other members are in agreement with what you say? You say that in Southern India rivers have been silted up. Which rivers do you mean?—We were given the list by our Southern India members.

A.2660. Have you a branch in Southern India as well?—We have got members representing Southern India, members coming from Southern India.

A.2661. In this Association?—They are employed in this Institute.

A.2662. Can you tell me what rivers you mean?—I have not the names of the rivers in mind at the moment, but if you want them I can supply them.

A.2663. You say they have silted up?—Yes.

A.2664. Why have they silted up? I have never heard of rivers being silted up; canals silt up. In the case of rivers if there is too much velocity they turn their course and make a new course for themselves?—The alluvium that is brought along with the water settles down.

A.2665. What is the velocity of the rivers which you speak of?—This information has been supplied by the members.

A.2666. You will supply this later on, I suppose?—Yes.

A.2667. *Sir Thomas Middleton*: How many persons are represented by the Association? What is the membership?—We have got more than 75 members.

A.2668. Of the 75 members how many have received a technical education or taken degrees in colleges like yourself?—I have not got the exact number, but it is about 50.

A.2669. So that a substantial proportion, the majority, consists of persons who have had a University or college training?—Yes.

A.2670. We understand that this memorandum was prepared by a committee of the Association; is that so?—The Questionnaire was placed before a general meeting and when it approved of the idea of giving replies to it, a committee was appointed to draw up the replies which replies were next discussed in the general meeting.

A.2671. Individual members of the committee would be responsible, I suppose, for the drafting of individual sections?—After drafting, this was again submitted to the meeting, and it was approved by the whole meeting.

A.2672. On page 293, with reference to recruitment, you are looking forward to a time, I take it, when the great majority of the persons engaged in research will be Indians. This is what the Association has been looking forward to in writing this?—Yes.

A.2673. And your view is that there should be scope in any scheme for allowing promotion from the lower to the higher grade without difficulty? Is that your intention?—Yes, that is so; not as a matter of course, but on merit. We would like that some of these posts should go to men in the lower grade.

A.2674. At the present time do promotions take place? Have they taken place in the past?—In two cases they have taken place.

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A.2675. And you think that there ought to be many more such promotions?
—Yes.

A.2676. The scheme you are preparing will deal with that point?—Yes.

A.2677. What is the initial pay of the grade in which you serve?—The initial pay is Rs. 250, that is of Class II officers, which is the same as the Provincial Service.

A.2678. Did you enter the service at Rs. 250?—No, when I entered, it was Rs. 200.

A.2679. What was the maximum at that time?—Rs. 250.

A.2680. When you started on Rs. 200 the possibility of increase was limited to Rs. 300?—Yes.

A.2681. What is the present maximum?—Rs. 800.

A.2682. So that entering at Rs. 250 officers in your position can rise to Rs. 800?—Yes, if they enter at the beginning.

A.2683. *Sir Henry Lawrence*: What are the increments?—Rs. 20 up to Rs. 600 and afterwards Rs. 25. But as we were promoted after 14 years' service it is doubtful whether we would reach the maximum.

A.2684. Did you join Government service on Rs. 200?—At Pusa I joined on Rs. 200.

A.2685. Originally when you joined?—At Poona I joined on Rs. 50.

A.2686. *Sir Thomas Middleton*: About what year did you join the service in Poona?—1908.

A.2687. And was that about the ordinary joining pay of students who were passing through the Poona College at that time?—No; the joining pay of the ordinary agricultural graduate was Rs. 30. But as I was a graduate in Arts as well as in Agriculture I was given a special higher start in pay.

A.2688. Can you tell me what the existing rates are there?—They begin on Rs. 100.

A.2689. Any graduate in agriculture who gets employment starts on Rs. 100?—Yes.

A.2690. *Sir Henry Lawrence*: That is not quite correct?—That is my information; but it is not less than Rs. 80.

A.2691. *Sir Thomas Middleton*: What I wanted to get at was the rise that had taken place on account of the increase in the cost of living. The agricultural graduate who formerly got Rs. 30 now gets how much?—Between Rs. 80 and Rs. 100.

A.2692. Does your Association hold the view that the recruitment of graduates to the service should in all cases be on one level, so that the higher posts should be gained by promotion?—We would not say all; but about 50 to 60 per cent should be by promotion.

A.2693. Turning to page 294 of your précis, I do not see what difference there is between the functions of the Agricultural Organiser that you ask for and those of the present District Agricultural Officers?—We would like to extend the functions of the District Agricultural Officer to the sub-divisions of the district and in addition to the present functions we would like this officer to enquire from the agriculturists themselves what are the exact improvements that they require. For example, the agricultural officer is at present engaged in bringing home to the agriculturists the improvements that have already been made by the department; but we would like him also to enquire what improvements the agriculturist himself requires, because it is just possible that the improvements made by the department are not necessarily those which the agriculturist himself would carry out in practice immediately.

A.2694. By introducing the term 'Agricultural Organiser' you are not thinking of a new officer but of increasing the number and extending the duties of the men who are of the type at present employed?—Yes, and therefore we have given him the name of organiser.

A.2695. Under "Field and Laboratory Facilities," your conclusion is difficult to follow. You say, "But if we compare the output of the Rothamsted Experiment Station with the work turned out at Pusa, we suffer in comparison. The reason for this is either want of skilled workers, or deficient organisation." These are not the only reasons. You cannot compare, for example, work that is going on in Pusa and work going on in Rothamsted. Rothamsted is an institution which is mainly devoted to the study of crop production, whereas you have several distinct sections of work in Pusa. If instead of comparing Pusa with Rothamsted you were to compare the publications of the plant breeding section here and those of the Plant Breeding Institute at Cambridge, you would have a legitimate comparison, and if in comparing Pusa with Rothamsted you counted the number of chemists that work here and there you might have a legitimate comparison. It seems to me that the reason is not necessarily either want of skilled workers or deficient organisation but may be due to confused thinking on the part of your Association. I think you must examine this point again, because you have made what seems to me to be a very severe criticism of Pusa?—We took Rothamsted simply because it was an institution well known to some of us on account of its publications to which we had to refer constantly in connection with the publications that we were also issuing from this Institute. We might quite well have compared the other institutes as well, but we thought that these two causes are to a certain extent responsible. We may have put it rather too strongly, but then we feel very strongly on the point, and if it is desired that we should compare other institutes, we should be quite willing to do so.

A.2696. You do not think that the amount of publication on the part of Pusa is sufficient, that is your feeling?—Yes, it is not sufficient, and also it is not considered of sufficient importance by the scientific world. In the importance attached to the Rothamsted publications and the Pusa publications we suffer in comparison.

A.2697. *Sir Ganga Ram*: Have you seen Rothamsted?—We are talking of publications of Rothamsted.

A.2698. But have you visited Rothamsted?—No, but I have come in contact with workers at Rothamsted.

A.2699. *Professor Gangulee*: Do you know when the Rothamsted Station was started?—I know it is many years since it was started and it is getting the advantage of having worked for a long time. We were, however, comparing the work done and publications issued from the Rothamsted Station and the Pusa Institute in the last ten years.

A.2700. It was started in the middle of the nineteenth century, was it not?—Yes.

A.2701. When was the Pusa Station started?—In 1904.

A.2702. *Sir Thomas Middleton*: On page 294 you say that unfortunately soil survey has been ignored. Do you mean by that that the soil survey of Bihar and of other Provinces of India has been ignored or that the examination of the Pusa soils has been ignored?—It is not quite clear from this whether we mean Pusa or the whole of India, but I think, if I remember right, we mean the whole of India; the soil survey as such is not carried out throughout the whole of India, nor has it been begun.

A.2703. Have you any conception of what a soil survey of the whole of India would mean?—We have, but we think a beginning should be made.

A.2704. Do you think you know how to begin?—We have a soil survey made in the Madras Presidency of some of the types of soils that have been dealt with by that department.

A.2705. *Sir Ganga Ram*: You say a soil survey has been done in the Madras Presidency?—It has been done in some of the districts.

A.2706. Can you tell us of any publication with regard to that?

A.2707. *Sir Thomas Middleton*: you were thinking of a soil survey of the type of the Madras soil survey?—Yes.

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A.2708. Sampling of soils and examination in the laboratory; that is not what is usually meant by a soil survey, but that is what you are thinking of at present?—Yes, that is what we are thinking of at present, the examination of the soils of different types.

A.2709. Taking samples, bringing them to the laboratory and examining them?—And mapping out exactly where those types of soil are met with in the districts.

A.2710. If you had confined your object to the first, I think your suggestion would have been better, because you will find when you come to mapping out that difficulties arise. In the next paragraph you remark that either for lack of co-ordination, or due to a deficient organisation, or for want of skilled workers, the analyses have not been corrected and standardised. I do not quite understand what that means. Is it your meaning that you have not devised standard methods?—Yes, we have not got standard methods adopted by the different departments and the methods themselves have not been completely standardised; wherever they have been done by the different methods it has not been shown how they can be correlated.

A.2711. Is it not the case that investigations on methods of analysis are at present being undertaken by the Chemical Section?—Investigation is being undertaken but not in the complete way that we would have liked. Some methods have been undertaken and some methods have been made official.

A.2712. What I do not understand is whether you complain that in making analyses standard methods have not been followed, or that no attempt has been made to improve upon existing standard methods?—We do not know which standard methods this department would like to follow, the methods followed are sometimes different.

A.2713. But under different conditions it may be necessary to vary the method?—Yes, but if we have a standard method, if it is necessary to vary the method, we would know that the particular method varies from the standard method and the reason why.

A.2714. You yourself are not familiar with this particular work, methods of analysis?—No.

A.2715. Then you express the view that there ought to be technological laboratories, so that suggestions which arise in the course of your investigations might be worked out on a large scale. That is item 5 on page 295. On the next page you suggest certain things for attention; you refer, for example, to milk products such as casein, milk powder and other agricultural subjects; that is the kind of thing you had in view?—Yes.

A.2716. On page 296, paragraph (iv), with regard to agricultural education, you say training in agriculture should be made attractive by teaching the boys to solve the agricultural problems of the locality. Has your Association attempted to discuss in detail how this could be done? Has it ever tried to prepare an experimental syllabus which teachers might employ?—We have not got a particular syllabus, but what we mean thereby is that in varied tracts, sugarcane tracts or particular crop tracts, agriculture would be more attractive to the boys of that tract if the problems of that particular crop or that particular locality were tackled.

A.2717. I think everyone will agree with that view, but you recognise, many of you having been students, that a teacher has great difficulty in introducing an experimental course, and what I asked was whether your Association had even given attention to the framing of experimental courses of this sort. Have you discussed such matters as the improvement of teaching?—What we think is that if particular experiments on those crops are carried out by the teachers, it will be more useful than simply talking on general agriculture.

A.2718. That is all you mean? You have not as an Association discussed questions of agricultural education from the technical point of view?—No, not from the technical point of view.

A.2719. All of you here are in a favourable position for discussing such questions, because you have all been through agricultural colleges and have had experience?—Yes.

A.2720. I wondered to what extent you have tried to improve agriculture?—We did not like to go into the details of the methods of preparing curricula and that sort of thing.

A.2721. I was not asking with reference to the preparation of this précis; I was asking with reference to the meetings of your Association. Are such matters discussed at the general meetings of your Association?—These matters are discussed in a separate association for the purpose; there is a separate association formed for the purpose of discussing these technical matters.

A.2722. In Pusa?—Yes.

A.2723. What is the name of that association? Are you not a member?—I am a member, it is an association of the assistants; it is called the Pusa Scientific Association.

A.2724. You commend a method of providing employment for middle class youths which we have had before us in many localities. On page 296 you suggest they should be provided with capital and with what you call decent sized blocks of land. Has the Association discussed this in detail, what is meant by a decent sized block of land? How many acres?—Of course I am not in a position to give the exact acreage but it should be of such a size as to yield a decent income.

A.2725. I am afraid it has not been given a decent discussion. This is a very important subject and I had hoped that it would have got a decent discussion from your Association?—If particular areas were referred to we would have given the exact acreage that would be necessary, but we did not know whether the land referred to was dry farming or irrigated tracts.

A.2726. *Sir Henry Lawrence*: What do you regard as a decent income?—I would regard Rs. 1,000 per year as a decent income.

A.2727. *Sir Thomas Middleton*: Have you made any estimate of the capital that would be required to earn a thousand rupees?—If the price of the land were not taken into consideration we consider that about Rs. 500 would be required. We are not taking into consideration the price of the land.

A.2728. Nor the man's own labour?—No.

A.2729. There is another important point on page 297. You think that agriculture should be introduced into high schools and that when boys come to study the subjects, chemistry, physics and botany, they should be required to get up these subjects for the Matriculation more or less from an agricultural point of view. That is your view?—We have provided for two kinds of people. One is for a class which would finish their education at the Matriculation standard or the school final. There we would have more practical agriculture. Those who go through the collegiate course would be required to learn science along with practical agriculture and, as they have to learn science, a little less attention to agricultural education should be given in the high schools as they would get it in the college.

A.2730. The object is good, but you as a student must know that getting up all these science subjects for the Matriculation is a heavy task and that the preparation in chemistry and physics at the present time is very indifferently done, the amount of chemistry and physics taught in Indian high schools is really very limited, so that a student has got to get his preliminary scientific knowledge at the college intermediate stage. Do you not think that it would be a mistake to add an additional subject like agriculture to the already heavy course which a Matriculation student has to follow? That is my difficulty?—We have dropped some of the subjects included in the present curriculum.

A.2731. You have modified the Matriculation examination?—Yes, we have substituted these subjects for the other subjects that we have taken out such as history and classical language. We have simply taken English or vernacular, mathematics and these subjects; the other subjects we have dropped.

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A.2732. It is not possible to frame an opinion on the scheme that you present in this general form, but would your Association be prepared to draft what one might describe as an ideal syllabus for the Matriculation examination? Then we should be able to see whether it might be acceptable or not?—The syllabus that we have drawn up does not interfere with the ordinary Matriculation syllabus. We have provided this syllabus especially for those people who would like to take agriculture as a practical subject and dropped out those theoretical subjects with which they have not got much concern at present and which are introduced as a sort of literary course.

A.2733. You are talking of the syllabus for the School Final examination now, not the Matriculation?—In most Provinces the School Final and Matriculation are being combined.

A.2734. *Professor Gangulee*: Have you actually drawn up the syllabus or is it still vague?—We have put down only the subjects to be taught and have not entered into the drawing up of a detailed curriculum.

A.2735. *Sir Thomas Middleton*: Then if they are combined, the Matriculation requirements rule the examination. Is not that so?—Yes.

A.2736. *Dr. Hyder*: On page 292, you say that all schemes drawn up by the Council should be submitted to the Finance Committee. Are you referring to the Standing Finance Committee of Pusa or to the Standing Finance Committee of the Assembly?—To the Standing Finance Committee of the Assembly.

A.2737. But these things do appear before the Standing Finance Committee of the Assembly?—We do not mean that these funds should be in the hands of the Institute.

A.2738. The Standing Finance Committee exercises a very rigid control over every rupee that is spent and it would be pleasing to the members of that body to have the support of officers of Government. Now then, will you please turn to the next page? Have you not got a Board of Editors for publications?—Yes, we have.

A.2739. Would you like to have a larger Board?—Yes.

A.2740. I do not know whether you have done any work of this kind, but it really is a one man's job; an editor must be an autocrat. Now then, will you refer to post-graduate training on page 293? If this Institute were affiliated to some Indian University then that would involve a certain measure of control by the University over the Institute. Would you like to have that sort of control?—When we drew up this memorandum we thought that it should be regularly affiliated to the University, but if it is desired that the University should not have any control over this Institute we would be satisfied if, as I was told recently, the Heads of sections are willing to take students for the Doctor's degree in any of the Indian Universities provided of course there are seats. If this fact is made known at the time of advertising for applications for admission into this Institute, we would be satisfied.

A.2741. I want you to be quite clear about this matter of affiliation. In the case of some Universities there cannot possibly be any affiliation because they are teaching residential Universities, e.g., Dacca, Benares, Lucknow, Aligarh, etc. You could only be affiliated to some territorial Universities and rigid conditions to affiliation are laid down. If this Institute is not prepared to accept the conditions laid down in the Regulations of the Universities I do not know how your Heads of sections can introduce boys at the time of inviting applications to an examination of the Doctor's degree of some Indian University?—We have many Universities granting the highest degrees possible for the work done in this Institute. For example, we had three degrees already granted to three Assistants for work done in this Institute.

A.2742. By what Universities?—The Calcutta and Bombay Universities. The Master's degree was granted by Calcutta and the degree of Master of Science by the Bombay University.

A.2743. I have not got the Regulations of the Calcutta University but there are, as you know, conditions attached to this affiliation; and, as regards this

degree granted by the University of Bombay, if you read the Regulations you will find that affiliation carries with it a certain measure of control?—So far as I understand the Bombay and Calcutta Universities are willing to grant degrees provided the work is done at any recognised institute; it need not necessarily be affiliated.

A.2744. There could be no granting of degrees by, say, the University of Bombay as regards study at some institute in Japan for instance, unless the Japanese Institute were affiliated, and therefore were recognised?—I got my degree from the Bombay University.

A.2745. Yes, because you were a graduate of the Bombay University?—Yes.

A.2746. That is a different matter?—But students admitted here are already graduates of their Universities, and the same also applies to Calcutta.

A.2747. Yes, in the case of Calcutta and Bombay. But you have, I understand, students here from other Universities and I do not know how you are going to give a Doctor's degree to a student coming from the United Provinces or the Punjab. The Bombay University would not recognise that. It may solve the difficulty of students coming from that particular University, but I understand that here you have students from all over India, from different Universities?—When English Universities like Oxford, Cambridge and London recognise degrees of Indian Universities there should be no difficulty for recognition of degrees of residential Universities by the territorial Universities.

A.2748. With regard to the duration of the course, take the case of a Matriculate. After joining he will get a degree in Agriculture after 4 years; is not that so?—Yes.

A.2749. Then, you want to give him the Master's degree in one year?—Yes.

A.2750. I will read out to you the regulation of the Bombay University. "Each candidate for the Degree of Master in Agriculture must be a graduate in agriculture of not less than three years' standing and must have been engaged in the practice of agriculture, or of work or research in connection with agriculture for a period of at least three years after receiving the Degree of Bachelor or Licentiate of Agriculture." You want to reduce the period?—Yes. The Bombay University is a bit conservative. It grants only the Master's degree. It has not yet given any Doctor's degree in any subject and therefore the degree of a Master in the Bombay University is equal to that of a Doctor in some of the other Universities.

A.2751. Let us consider three stages, the B.A. degree, the Master's degree and the Doctor's degree. For B.A. you require 4 years; for M.A. you require at least 2 years and although there is no period fixed for the Doctor's degree, you require at least three years. You want under your scheme 4 years for the B.A. degree, one year of the M.A. degree and 2 years for the Doctor's degree. Is that so?—Yes.

A.2752. But most of your suggestions do not tally with the regulations laid down for the obtaining of such degrees by the Indian Universities. That is surely a lowering of the standards?—We would be willing to extend this period by about one year, if that is considered essential by the University Regulations. Instead of 7 years we would extend it to 8 years; 4 years for the B.A., 2 years for the M.A. and 2 years for the Doctor's degree.

A.2753. Even then you get into conflict with the regulations of most of the Indian Universities. Here is the regulation for obtaining the Doctor's degree of the University of Madras. It says that the degree of Doctor of Science can be given only when three years have elapsed from the time when the student took his degree of Master of Science?—The course here at Pusa is for 2 years and in this period of 2 years sufficient research work is being done. The conferment of the degree depends upon the work that is done and the quality of the work done is of sufficient importance to be recognised by the Universities. It is immaterial whether the number of years is three or two.

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A.2754. Let us turn to the University side of the matter. Do you think that the Indian Universities are capable of dealing with publication of theses which will be submitted from Pusa? Do you think that most of these Universities have Chairs in Agriculture and Chairs in many of the natural sciences?—They have got Chairs in Natural and Physical sciences.

A.2755. Take the case of students studying entomology or mycology. Have you a Chair for those subjects in the University of Bombay?—The Agricultural College is there.

A.2756. The whole thing will come back to Pusa like a boomerang. The students will be taught here, their work will be done here and their examiners will have very little say in the matter?—My thesis was examined by the Bangalore Institute.

A.2757. *Sir Henry Lawrence*: On that you were given an M.Sc. degree by the Bombay University?—Yes.

A.2758. *Dr. Hyder*: With regard to the matter of promotion from the provincial ranks, how would your suggestion of 50 per cent of the posts fit in with the general scheme of Indianisation? In the case of the Indian Civil Service or the Police, you know that the ideal is to have 50 per cent posts for members of Indian domicile and 50 per cent for members of non-Indian domicile. It does not mean that 50 per cent of persons of Indian domicile should all come from the Provincial Civil Service. You want everything for the Provincial Service?—We are looking to the time when the Imperial Agricultural Service will be entirely manned by Indians and of that we require this 50 per cent.

A.2759. That is perfectly correct and I follow you there. But according to you this 50 per cent would be entirely confined to promotion from the lower ranks?—Yes, and 50 per cent from direct recruitment. We are talking of the time when the policy of Indianisation will be given effect to and then there should be 50 per cent direct recruitment of Indians and 50 per cent from the lower ranks.

A.2760. That proposal would not fit in with the general scheme of Indianisation. No such percentage is laid down for promotion from the ranks below?—It is not a question of laying down an exact percentage. It is a question of bearing this fact in mind and giving promotion to men of the lower ranks; otherwise the position would be that students trained in this Institute would be given posts in the Imperial Service by direct recruitment and the people responsible for carrying out their education from the beginning would have to serve under them. Therefore the students passing from this Institute would be the direct superiors of the men in the Provincial Service.

A.2761. *The Raja of Parlakimedi*: You know that Agriculture is a Transferred subject in every Province and Irrigation is Reserved. You also know that agriculture and irrigation go hand in hand. Have you got any suggestions to make on that point?—Our Association has not thought out the matter about Transferred and Reserved subjects, and I would not like to venture to express an opinion.

A.2762. On page 293 you say, “unfortunately in India this aspect of the organisation of research has not been properly appreciated”. Are you satisfied that the public know what is going on here?—What we mean to say is that the sectional meetings that were started are no longer held and we would like to have them revived. When we say it has not been recognised in India, we mean that it has not been recognised by the different Provinces in India or the different Ministers, so to say. They have not appreciated the advantage of these sectional meetings and they have failed to provide funds for sending their representatives.

A.2763. You do not mean the public?—No.

A.2764. On page 294 you compare the work done here and the work turned out at the Rothamsted Experiment Station. May I know whether Pusa has got the same advantages as the Rothamsted Experiment Station has so far as funds, situation and standing are concerned?—Of course, Pusa has not got the same standing.

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A.2765. Would you take that factor into consideration?—When we drafted this note we took these facts into consideration. When we say that we suffer in comparison we mean that we ought not to have suffered so much in the natural course of things. Although we follow the practice of the Rothamsted Experiment Station in many ways, we find that we are still lagging behind. That is the opinion of the Association.

A.2766. You mean to say that you have taken the whole situation fully into consideration?—Yes.

A.2767. On page 294 you have made certain remarks about lack of knowledge of cultivator's problems and 294 you talk about the language difficulty. May I ask you to make your proposals more definite. They are rather vague?—I may tell you that we do not attach so much importance to the language difficulty. But as regards paragraph 2 on page 294 regarding the lack of knowledge of the cultivator's problems, we would like to submit a further note of explanation. (*Vide Appendix*).

A.2768. Then you propose the introduction of agriculture as a subject in the schools?—Yes.

A.2769. What language do you propose to have as the medium of instruction at different stages?—We thought about the question of the medium of instruction; I think the medium of instruction had better be left to the Education Department to work out; it matters very little, so long as the subjects that we suggest are taught.

A.2770. And efficiently also?—Yes.

A.2771. Do you not agree with me that they should be taught in a manner that will be easily assimilated by the students?—Certainly.

A.2772. That you would leave to the educationists?—Yes.

A.2773. *Sir James MacKenna*: Who started this Association?—It was started as a result of several meetings that we had, and the general feeling was that we should have a sort of Association to represent our grievances.

A.2774. Who is the leading spirit?—I am afraid I cannot tell you.

A.2775. Who are your executive committee?—One man is chosen from the different classes, e.g., gazetted officers, scientific assistants, fieldmen, etc.

A.2776. Am I correct in thinking that the Association is more concerned with service questions than with agriculture?—Yes, primarily it is intended for that.

A.2777. When you joined service, you were getting Rs. 50 in Poona?—Yes.

A.2778. What did you join as?—I joined as a Demonstrator in chemistry.

A.2779. What are you drawing now?—Rs. 520 a month.

A.2780. Rising to the Rs. 800 grade?—Yes.

A.2781. How many years' service have you had?—I joined in 1908; I have put in 18 years' service.

A.2782. And, during that time, you have risen from Rs. 50 to Rs. 520. How much did your education in bacteriology cost you?—It has not cost me anything, because I took pains to learn the subject myself at home. When I joined on Rs. 50, I was told to carry on some of the experiments on the *rab* system of cultivation besides my usual work of demonstrating in chemistry, for which I was chiefly engaged. I was studying chemistry and geology also for my B.Sc. examination.

A.2783. *Professor Gangulee*: Why did you learn it?—I was asked to carry on an investigation into the *rab* system under Dr. Mann in my spare time, after taking the classes, and I specialised in it of my own accord as I wished to do the work thoroughly.

A.2784. In which year was that?—1908.

A.2785. *Sir James MacKenna*: You say, "The delay in publication of the results obtained by research workers in the various departments of agriculture in India hampers to a great extent the progress of research." Is it not a fact that in every publication of the Pusa Institute there is noted at the top "Received for publication on such and such a date"?—Yes, that is so.

A.2786. And is it not a fact that it is the etiquette of scientific workers to give priority in any piece of investigation to a statement of that kind?—Yes.

In that case, there is no particular hampering of research due to delay of publication in Pusa.

A.2787. *The Chairman:* Have you got the objects of your Association printed or typed?—Yes, we have.

A. 2788. Would you hand me a copy?—We have given them in the beginning of our note.

A.2789. Have you a copy of the by-laws?—We will supply you with one.

A.2790. *Professor Gangulee:* Could you give us also the articles of Association?—Yes.

A.2791. You have told us that 50 of the members belonging to your Association are research workers?—Yes, about that number.

A.2792. You talk about the establishment of a scientific brotherhood; have you established that brotherhood amongst those 50?—Yes, to a certain extent.

A.2793. What do you actually mean by scientific brotherhood?—The spirit of helping the scientific worker in different aspects.

A.2794. Do you discuss scientific problems in your Association?—There is a separate Association, called "the Pusa Scientific Association".

A.2795. I am asking you about this particular Association of which you are Secretary?—The Pusa Scientific Association had the prior existence, and this Association did not take up that particular branch.

A.2796. You are now here before us as the Secretary of the Imperial Agricultural Department (Pusa) Association. I want to know whether, at any time, you have discussed scientific problems amongst yourselves?—This Association did not take up those duties, because the scientific members of this Association are included in the Pusa Scientific Association.

A.2797. This Association, although they have 50 members doing research, have never at any time discussed any scientific problem?—No.

A.2798. From that one could say that you have not developed the spirit of scientific brotherhood that you would like to see established; am I right?—The same persons who are members of this Association are also members of the Pusa Scientific Association and the mere fact of the non-amalgamation of the one with the other does not mean that we have not got the spirit of brotherhood, because in the Pusa Scientific Association we do discuss scientific problems.

A.2799. When was the Pusa Scientific Association formed?—About 3 years ago.

A.2800. It is mostly composed of Indians?—Yes.

A.2801. Do you discuss scientific problems there?—Yes.

A.2802. Do you have minutes of the proceedings?—Yes.

A.2803. Could you give us a list of the subjects you discussed for the last six months?—We submit a précis of these discussions to the *Agricultural Journal**, and I think we could supply you with them.

A.2804. You feel the necessity of establishing sectional conferences; how many conferences of your own section were held?—Two.

A.2805. Did you take part in those conferences?—Yes.

A.2806. Did you read any paper?—There was no question of reading any paper, but we had to discuss several subjects that came before us.

A.2807. Did you participate in the discussion?—Yes.

A.2808. I cannot understand what you really mean by "unsystematised research" on page 294; will you explain?—By unsystematised research we

* *Agr. Jour. of India*, March, 1926.

mean research undertaken not on the basis of a full survey of the cultivator's problems, but on any subject that the scientist himself thinks worth tackling.

A.2809. Could you tell the Commission a single item of research undertaken by your section, which may be classified as a piece of unsystematised research?—By unsystematised research we mean that the kind of work that we do is not necessarily connected with the agriculturist's or ryot's needs as given out by the agriculturist or by the Agricultural Department; we have to select our own problems.

A.2810. You are confusing the whole situation, I am afraid. I want to know from you whether you can tell the Commission that your section undertook any piece of research which could be classified as unsystematised research?—I want to know whether you mean unsystematic work.

A.2811. Unsystematised research; I take the words you have used here?—We are not talking about unsystematic work; we are talking about research on points undertaken at our discretion. We are responsible for the research that we undertake; we are not told what work is desired from our section by the cultivators or the agriculturists or the Agricultural Department.

A.2812. You want the problems to be tackled by your section to be dictated by cultivators?—Not dictated.

A.2813. Suggested?—Yes.

A. 2814. Are you familiar with foreign scientific journals?—So far as my work is concerned, I am.

A.2815. Would you agree with me that Pusā has established a scientific reputation?—It has a certain amount of scientific reputation.

A.2816. It has established a certain amount of scientific reputation. Please turn to page 294 and tell me how could that reputation be established under the conditions alleged by you, that is, want of skilled workers and deficient organisation?—There we are referring to the fact that our reputation is not equal to that of Rothamsted.

A.2817. I am not referring to Rothamsted at all; that has been done by Sir Thomas Middleton. This institution was established in 1906, and in 20 years' time has turned out work on which it can base its reputation. You allege here that there is a want of skilled workers and that there is deficient organisation and unsystematised research?—We mean thereby that our reputation would have been greater if these causes did not exist.

A.2818. With regard to your own research, how many years have you been engaged in this Institute?—About 16 years.

A.2819. Could you tell the Commission the nature of your own research, and whether you have done so systematically?—I was working with Dr. Mann on the *rab* system of rice cultivation in Western India, and on the bacteriological rot of stored potato tubers with Mr. Hutchinson. I was carrying on work on the bio-chemical decomposition of organic manures and green manures, and I have published several articles on that subject in the *Agricultural Journal of India*. I have got out 2 memoirs in my own name, for one of which I obtained a science degree of the Bombay University, and I have a bulletin on the manurial value of the different parts of green manure; recently I have submitted a paper on the economic method of green manuring to the Science Congress.

A.2820. How many of these various researches were undertaken on your own initiative and how many at the suggestion of your superior officers?—Bacteriological rot and the *rab* system of rice cultivation were the suggestions of my superior officers; the bio-chemical decomposition of green manure and others organic manures was taken up by myself, after I had assisted Mr. Hutchinson in some of his work. The independent memoirs were practically on my own suggestion; they are of theoretical value only; the bulletin and Science Congress paper that I am talking of are but the development of my own work on the decomposition of green manures and other organic manures.

A.2821. In that work, you received no assistance whatever from the Head of your section?—Nothing except encouragement and discussion on some of

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the questions, but without the encouragement of and discussion with the Head of the section it would not have been possible to carry it out.

A.2822. That is precisely the point I wanted from you. In reply to the Chairman you stated that when problems of research are undertaken, the Heads of sections do not take the trouble to explain the scheme to you as a whole and do not take you into confidence when they chalk out their lines of research. Has that been your own experience in your own work?—The problems that I was dealing with generally had no concern whatsoever with the Heads of the different sections. They were entirely taken up in our own laboratory.

A. 2823. I am only talking about your own section?—When joint schemes are discussed with the Heads of the sections then there is a possibility of this happening. When the problem is carried out in one laboratory and is confined to one laboratory then this does not happen.

A.2824. So far as your own work is concerned you have no complaint?—No.

A.2825. Have you read much about the research organisations of other countries?—I have read something; not much.

A.2826. So the remarks that you make here with regard to research organisations are based on insufficient knowledge?—There is a difference. Personally I may not be acquainted with them, but the other members who drew up the answers and made suggestions have had a certain amount of knowledge of research organisations.

A.2827. Then you make suggestions with regard to the Provincial Departments of Agriculture. Have you followed their work closely? How activities like demonstration and propaganda are carried on? I want to know whether you are in touch with the Provincial Departments of Agriculture?—We are to a certain extent; I am personally with one or two Provinces and the other members with other Provinces.

A.2828. When drawing up this précis did you consult the members of your Association?—Yes.

A.2829. Has any member of the Association any knowledge of rural economics or rural conditions?—We have got a knowledge of rural conditions, but have not made a study of rural economics as an academic subject.

A.2830. *Mr. Calvert*: Do I gather from your answer to Prof. Gangulee's last question that your Association does not interest itself in rural economics?—It has interested itself in rural economics; but we have not got a knowledge of rural economics as studied, say, in the colleges.

A.2831. On page 291 there is a note about the average yields in various countries. Is that a fair sample of the economic knowledge of your Association?—You mean the figures that we have given?

A.2832. Yes?—We have given these figures from the different references that we could get.

A.2833. You have deduced from those figures that we are not producing as much as we should. Is that a fair sample of the economic knowledge of your Association?—I do not know whether it is economic knowledge, but we think that, because other countries are producing more and there is a possibility of getting greater yields in these different commodities, there is no reason why, unless proved to the contrary, our country also should not come to the same position as that arrived at in other countries.

A.2834. Which do you think has a higher yield in wheat, the United States of America or the Punjab?—We are talking of the whole of India; we have not specially studied the Punjab wheat. But I enquired and found out that the yield of wheat in the Punjab comes to about 17 to 22 maunds in the irrigated tracts.

A.2835. *Sir Ganga Ram*: You enquired from where?—From the Lyallpur College students who had come to the Science Congress.

A.2836. *Mr. Calvert*: On page 292 you say, "we shall not only lose our hold (of the export markets) with disastrous consequences to our agricultural

community, but also our domestic markets may be invaded by foreign producers as they have done in the case of sugar." Do you think those two processes can go on together?—I think the losing of the home markets would come subsequently, subsequent to losing our export markets.

A.2837. *Mr. Kamat*: With reference to your remarks about a certain proportion of appointments in the higher service being given to deserving candidates in the lower groups (page 294) will you please tell me what is precisely the present difficulty? Is it statutory or is it under the executive rules or what? That is to say, supposing there is a man who has distinguished himself here at Pusa by scientific work, is there any inherent difficulty in the way of his being taken up by a Minister of a Province for a superior post in the Provincial Service?—There is no statutory difficulty in theory, but in practice we find that men here are not taken up by the Provinces.

A.2838. You have gone through the Lee Commission's recommendations, I presume?—Yes; we have.

A.2839. They have made it perfectly clear that recruitment for the Agricultural Service is now entirely in the hands of the Ministers?—Yes.

A.2840. And if they choose they can obtain their recruits through the Public Service Commission which has now been appointed?—Yes.

A.2841. Under the circumstances is there a clear-cut statutory difficulty? Or is it only due to the present operation of executive rules? Have you ascertained that?—The difficulty is only in practice; it does not exist in theory.

A.2842. So it is only the practice you have to break down if you want your point to be carried?—Yes.

A.2843. On page 294, amongst the list of handicaps you cite the instance of lack of knowledge of cultivators' problems on the part of the officers here. You say "Agricultural Experts who are recruited from abroad are sometimes inclined to transplant the methods obtaining in their country without modifying them according to the local conditions"; and you quote the instance of cattle breeding by crossing the country cows with imported bulls. Your Association thinks that this method of cross breeding is entirely on the wrong lines?—Without having dealt with the indigenous breeds by themselves, it was wrong to have paid so much attention to cross breeding.

A.2844. Is there any other instance which you have in mind, broadly speaking, which could be cited by your Association to show that research work carried on by the superior officers here is on the wrong lines? I want you to be perfectly outspoken?—You mean the research work done by the experts. The Association has had no definite instances pointed out by its members. So I am not just now in a position to say anything.

A.2845. You have no particular instance in mind?—Just now I cannot say.

A.2846. It is a question of the interests of science; it is not a question purely of Subordinate and Superior Service?—But the position is this. Unless I am given definite instances by the members I am not in a position to say anything.

A.2847. I need not go into the scientific part of the question. I am just asking you to give an illustrative instance to show how the lines on which the superior officers are working do not reflect the needs of the cultivator?—I have not got any other instances just now but if you want instances that the members had in mind I can give them later on.

A.2848. I do not want to go into the merits of cross breeding, but this instance is quoted by you just to show that there is not that friendly co-operation and that exchange of views between the superior officers here and the assistants when working on a problem that is desirable; is that what you mean by quoting this instance? I wish to make myself perfectly clear. The question I am asking you is not whether their method of cross breeding is right or your idea of breeding is right. You may be right or they may be right; that is entirely a different question. But you cite this instance in

your honest belief that the superior staff in their lines of research are divorced from the needs and the minds of the cultivators; is that right? That is the honest belief of your Association?—Yes; that is so.

A.2849. And therein lies the germ of your complaint?—Yes.

A.2850. That the superior officers do not consult you or take you into their confidence when they chalk out their lines of research?—Yes.

A. 2851. What you further desire is a freer exchange of views?—Yes.

A.2852. A more friendly discussion, on and off, between assistants collectively or individually and the superior officers collectively or individually?—Yes.

A.2853. Therefore the question of comradeship only resolves itself into a freer exchange of views with a more friendly feeling?—Yes.

A.2854. Nothing further than that? How many members are there in the Science Section of your Association?—I cannot give you the exact number but there are about 40 or 50 members. It began with 47 members but now it has 38.

A.2855. That you have formed yourselves into an association itself shows that you are beginning to have a sense of brotherhood?—Yes.

A.2856. The fact that you have set yourselves the task of taking up some research work, independently of the problems assigned to you by your superiors for solution, itself shows that you desire to work on a voluntary basis apart from your official duties?—We take up scientific subjects for discussion at the Pusa Scientific Association.

A.2857. And although at the present moment you may not have systematised and standardised your lines of research work which you are doing on a voluntary basis, still that spirit ought to be encouraged?—Yes.

A.2858. To a man of science this should be regarded as a healthy sign?—Yes.

A.2859. *Sir Ganga Ram*: When you speak of land being given by Government to unemployed students, where are the lands of which you are thinking; can you give me specific lists of lands which Government could distribute?—No, we have no specific lists.

A.2860. Then are these Government lands?—We understand there are some colonisation schemes under Government and Government has got some lands.

A.2861. Do you suggest under your scheme that Government should give these lands to students for nothing as a gift, or should sell them, or what?—We have suggested that the price of the land should be paid at the rate of about 3 per cent per annum and be realised in the course of 60 years, the owner after this period holding the land in fee simple, as is done for the landless in Ireland.

A.2862. Do you mean that Government should borrow at 5 per cent and lend at 3 per cent, because 5 per cent is the Government rate now?—No. If we take the value of the land as being 100, Government should realise 180 per cent in 60 years; that is our idea.

A.2863. But should Government do this with its own lands or should it buy the land?—Use its own lands.

A.2864. But where are these lands belonging to Government?—You want to know a specific area?

A.2865. I want to have a list of the Government lands which Government could give to you?—We have not prepared any specific lists of that kind.

A.2866. Will you send me such a list?—Yes, if it is available.

A.2867. I ask you for it. Since this Association has been recognised by Government, have you sent the proceedings to Government?—Not all the proceedings but we send in, annually, the report and the exact number of members.

A.2868. Are you not bound to send the proceedings?—They have not asked us to send the proceedings in detail.

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Then it is their fault.

A.2869. *The Chairman:* Have you yourself come across instances where subordinate members of the scientific staff engaged in detailed operations in connection with some scheme of research have not been told what that scheme of research was?—It is difficult to say because, so far as I myself am concerned, if the Head of the section did not tell me everything, I went to him and worried him until I got the information as to why he required a certain experiment to be carried out and why he did not wish other experiments to be carried out; thus I got the required information; but I find that other Assistants have not adopted that practice; they have perhaps not been encouraged to ask such questions, and therefore the complaint has arisen from them.

A.2870. Can you give me a single instance in which Assistants, other than you yourself, have failed, either through lack of the necessary initiative to ask, for information, or through lack of sympathy on the part of their chief, to inform themselves or be informed?—It would be difficult to give an instance on the spur of the moment.

A.2871. I am only asking for a concrete instance. Can you give me a concrete instance?—If we have to give a concrete instance, I think I would rather give it in writing later on than publicly here.

A.2872. Then perhaps you would put in two typical instances. Will you make a note of that?—Yes.

(The witness withdrew.)

The Commission then took evidence in the Central Provinces, the United Provinces and Delhi from 17th January to 22nd February 1927. For the proceedings of meetings, except the evidence of Mr. G. S. Hardy and Dr. D. B. Meek which follows, see Volumes VI, VII and VIII.

APPENDIX.

The Association is of opinion that a survey of the cultivator's problems should be made through the agency of the Agricultural Organisers, *i.e.*, (the district and sub-divisional agricultural officers with the added function of enquiring from and discussing with the actual cultivators as to their needs and the difficulties the cultivators have to contend with).

Out of the problems thus surveyed the problems requiring solution will naturally be distributed by the Agricultural Department among its different experts. This practice should be regularly followed and the department should thus keep itself more in touch with the actual needs of the cultivators, than direct its attention to experiments on machinery or manures which the cultivator cannot afford to buy at present. That is what we mean.

Saturday, February 19, 1927.

DELHI.

PRESENT :

The MARQUESS OF LINLITHGOW, D.L. (*Chairman*).

Sir HENRY STAVELEY LAWRENCE,
K.C.S.I., I.C.S.

Sir THOMAS MIDDLETON, K.B.E.,
C.B.

Rai Bahadur SIR GANGA RAM, Kt.,
C.I.E., M.V.O.

Sir JAMES MACKENNA, Kt., C.I.E.,
I.C.S.

Mr. H. CALVERT, C.I.E., I.C.S.

Professor N. GANGULEE.

Dr. L. K. HYDER.

Mr. B. S. KAMAT.

Mr. J. A. MADAN, I.C.S.

Mr. F. W. H. SMITH.

} (*Joint Secretaries.*)

**MR. G. S. HARDY, I.C.S., Member, Central Board of Revenue,
Government of India.**

**Memorandum prepared by the Government of India on Tariff Concessions granted in
aid of Agriculture.**

The concessions given may be classified under 4 main heads:—

I. Manures. (Item 9 of the Statutory Import Tariff Schedule);

II. Agricultural implements. (Item 15);

III. Dairy appliances. (Item 16); and

IV. Water-lifts, sugar mills, oil-presses, and parts thereof worked by
manual or animal power. (Item 18.)

These are dealt with seriatim below:—

I. *Manures*, all sorts, including animal bones, have always been exempt from Customs duty. Prior to the passing of the Indian Tariff Act, XVI of 1894, they were exempt as they were not mentioned in the schedules of the Tariff Act, VIII of 1894, and there was subsequently no authority to tax them. They were mentioned for the first time in the Tariff Act, XVI of 1894, where they were shown as free from duty. Although there is nothing specific on the point, their exemption is no doubt due to their value to agriculture.

Chemical manures of certain kinds were subsequently made free from duty in 1898 in deference to the views of His Majesty's Secretary of State for India, who suggested that chemicals which were imported exclusively for use as manures and could not be converted to other uses, except at a prohibitive cost, should be exempted from duty. When the general rate of import duty was raised from 5 per cent to 7½ per cent *ad valorem* in 1916, it was at first proposed to make manures including chemical manures, liable to import duty at 2½ per cent, but the items were retained on the free list at the instance of the Secretary of State. Since then it has become the accepted policy of Government to admit free of import duty chemical preparations used as manures which satisfy the conditions laid down in 1898 and additions to the list of exempted manures have accordingly been made from time to time. The existing list reads:—

“ 9. Manures, all sorts, including animal bones and the following chemical manures: basic slag, nitrate of ammonia, nitrate of soda,

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muriate of potash, sulphate of ammonia, sulphate of potash, kainit, salts, carbo lime, urea, nitrate of lime, calcium cyanamide, mineral phosphates and mineral superphosphates.”

II. *Agricultural implements* when constructed so that they can be worked by manual or animal power were liable to the general rate of import duty, viz., 5 per cent up to November 1903.* Agricultural machinery worked by power other than manual or animal, however, came in free of duty as machinery. This position was considered illogical and certain machines restricted to purely agricultural uses but worked by manual or animal power were exempted from import duty in November 1903 by Notification under Section 23 of the Sea Customs Act. It was also stated that additions to the list be made from time to time as other improved implements come into use. Parts of exempted agricultural implements which can be readily fitted into their proper places in the implements for which they are imported and cannot ordinarily be used for purposes unconnected with agriculture were admitted to the concession in 1908 by executive instructions.

In 1916 an import duty of 2½ per cent *ad valorem* was levied on machinery and component parts worked by power other than manual or animal for the first time, but agricultural implements and parts thereof worked by animal or manual labour were retained on the free list at the instance of the Secretary of State. The position before 1903 was thus reversed in 1916, i.e., agricultural implements worked by manual or animal power were allowed free while those worked by other power had to pay duty at variable rates. This anomaly was rectified by Commerce Department Notification No. 6573, dated 2nd October 1920, which extended the exemption to the agricultural implements and component parts to those worked by power, other than manual or animal. Statutory effect was given to this decision when the Tariff Schedules were revised in 1921.

New forms of agricultural implements not ordinarily used for purposes other than agriculture have been added to the free list which now stands as under:—

- “ 15. The following Agricultural Implements, namely, winnowers, threshers, mowing and reaping machines, binding machines, elevators, seed and corn crushers, chaff-cutters, root cutters, ensilage cutters, horse and bullock gears, ploughs, cultivators, scarifiers, harrows, clod-crushers, seed-drills, hay-tedders, hay-presses, potato diggers, latex spouts, spraying machines and rakes; also agricultural tractors; also component parts of these implements, machines or tractors; provided that they can be readily fitted into their proper places in the implements, machines or tractors for which they are imported, and that they cannot ordinarily be used for purposes unconnected with agriculture.”†

III. *Dairy appliances*.—When making suggestions in 1903 as to the agricultural implements to be exempted from duty, dairy machinery and appliances were mentioned by the Inspector-General of Agriculture, but these articles did not find place in the notification eventually issued. Subsequently, in 1904, the Inspector-General of Agriculture specifically asked that dairy machinery of every description might be exempted, and the then Revenue and Agriculture Department expressed the view that the dairy industry, which was an extensive one, should be fostered as far as possible. As a result, certain dairy

* With the exception of water-lifts, sugar mills, oil-presses and parts thereof.

† Under Government of India, Finance Department (Central Revenues), Notification No. 18, dated 17th June 1926, the following agricultural machines are also exempt from payment of import duty:—

Beet Pullers, Broadcast Seeders, Corn Pickers, Corn Shellers, Culti Packers, Stalk Cutters, Huskers and Shredders, Potato Planters, Lime Sowers, Manure Spreaders and Listers.

appliances, when constructed so that they can be worked by manual or animal power, were exempted. Like concessions (I) and (II) this concession was also continued in 1916. In 1920 parts of dairy appliances which can be readily fitted into their proper places in the appliances for which they are imported and which cannot ordinarily be used for other than dairy purposes, were exempted from duty and for the reasons explained in (II) above, the concession was extended in 1921 to the dairy appliances and component parts worked by steam or other power.

The existing entry in the Tariff Schedule reads as follows:—

- “ 10. The following Dairy Appliances, namely, cream separators, milk sterilizing or pasteurizing plant, milk aerating and cooling apparatus, churns, butter dryers and butter workers; also component parts of these appliances, provided that they can be readily fitted into their proper places in the appliances for which they are imported, and that they cannot ordinarily be used for other than dairy purposes.”

In addition milking machines and such component parts thereof as can readily be fitted into their proper places in the machines and cannot ordinarily be used for other than dairy purposes, have been exempted from import duty by the Central Board of Revenue Customs Notification No. 7, dated the 5th February, 1927.

IV. The exemption in favour of water-lifts, sugar mills, oil-presses, and parts thereof, goes back to 1894 (*c.f.* No. 13 of Schedule IV to the Indian Tariff Act, XVI of 1894). The Select Committee appointed to consider that Bill observed: “ We have exempted from duty water-lifts, sugar mills and oil-presses as well as all machines ordinarily used in the process of husbandry or for the preparation for use or for sale of the products of husbandry which the Governor-General in Council may by notification exempt.” During the general revision of 1921, a suggestion was made that the exemption in respect of water-lifts, sugar mills, oil-presses and parts thereof worked by manual or animal power might be cancelled but the point was not pursued further and they still continue to be on the free list, while those worked by power other than manual or animal pay import duty either at 2½ per cent. under item No. 51 or 15 per cent under item No. 96 of the Statutory Tariff Schedules.

The existing entry reads:—

- “ 18. *Water-lifts, sugar mills, oil-presses*, and parts thereof, when constructed so that they can be worked by manual or animal power.”

Replies to the Questionnaire.

QUESTION 21.—TARIFFS AND SEA FREIGHTS.—Except in so far as the general tariff raises the cost of living to the cultivator to a small extent, the Customs importers' duties do not seriously affect the prosperity of the Indian cultivator. The Commerce Department memorandum* contains a list of the many concessions given to the agricultural industry, but of these it may be said that they form a patchwork of individual ideas rather than a carefully thought-out and well-balanced scheme.

2. I express no opinion as to whether it is desirable that all raw materials or accessories of the industry should be admitted free, but will merely indicate some of the directions in which the present concessions fall short of this standard. Item 15 of the Tariff which deals with Agricultural Implements relates only to certain specified instruments. The Government of India have generally proved willing to add to that number any that may be brought to their notice whose primary purpose is agricultural. But to make additions to the list takes time, and concessions cannot legally be given with retrospective effect. An alternative course would be to make all agricultural implements free without specifying any by name. To this there is the objection that it would throw on Collectors of Customs the onus of deciding whether a particular article fell within the definition. Different decisions might be given at different ports; after a time the discrepancy would be discovered and the Central Board of Revenue would issue a ruling, and in this way a body of case-law would grow up round the item. Now this is an admitted defect in other parts of our tariff which has recently been the subject of severe criticism from the Associated Chambers of Commerce, who have complained that under many heads the tariff itself is vague and that the case-law which elucidates it is not available to the public.

3. Items 16 and 18 are similarly specific. Item 9, Manures, is specific only so far as chemical manures are concerned, and in respect of additions to this list the policy of Government is to include only such chemicals as cannot be ordinarily used without further expense for other purposes.

4. Grain and pulse are free, and in so far as they are imported for seed purposes, this constitutes a concession. Imports for food purposes only occur in considerable quantities when there is a shortage in India, e.g., in 1925-26, when wheat exports fell from 1,111,000 tons to 212,000 tons, 35,000 tons of wheat were imported from Australia, so that freedom from duty can hardly be regarded as affecting the cultivator adversely.

5. Seeds, seedling plants and cuttings are liable to 15 per cent duty and imported materials used for irrigation schemes are subject to the appropriate rate of duty.

6. Other parts of the tariff bearing indirectly on agriculture are the duties on agricultural produce. As has been mentioned above, grain and pulse are free. Raw cotton is also free, but consists for the most part of Kenya cotton of which about half is re-exported. The other important items are "sugar," "fruits," and "vegetables" and spices."

The specific duty on sugar (Rs. 4-8 per cwt. for white sugar and Rs. 4 for brown) is at present equivalent to an *ad valorem* duty of about 37½ per cent.

8. The duty on fresh fruits and vegetables is 15 per cent and its rise from 5 per cent to this figure appears to have had a definitely protective effect since, despite the rise in prices, the value of imports has dropped from Rs. 20 lakhs in 1913-14 to Rs. 17½ lakhs in 1925-26.

9. On spices the duty is also 15 per cent but in this case the rate does not appear to have had a depressing effect on the import trade which has risen from 63,704 tons in 1913-14 (including 56,904 tons of betel-nuts) to 70,600 tons (including 63,584 tons of betel-nuts) in 1925-26. The Customs

*Vide pages 336-338.

revenue from spices in the latter year was 50 lakhs, and the amount has been increasing annually.

10. The export duties affecting agriculture are those on rice and jute. These are discussed in paragraphs 154—157 of the Report of the Indian Taxation Enquiry Committee, 1924-25. The rates of duty are:—3 annas a maund on rice and Rs. 4-8 per bale of 400 lbs. on raw jute.

QUESTION 26.—STATISTICS.—I would commend to the attention of the Commission the method adopted in Burma for the preparation of the final rice forecast. The forecast is made at an annual conference presided over by the Settlement Commissioner at which the Collector of Customs and the leading rice merchants are present. In Bengal the jute forecasts are prepared by the Director of Agriculture without the assistance of trade advice. They are thus much less accurate than they might be. They are kept secret up to the moment of publication, are the subject of considerable gambling, and frequently exercise a disproportionate effect on the trend of prices.

Oral Evidence.

A.2873. *The Chairman*: Mr. Hardy, you are a Member of the Central Board of Revenue and you are one of the two Members of the Board?—Yes.

A.2874. Your colleague is in charge of accounts and you, Mr. Hardy, are in charge of Customs matters?—We deal with important matters jointly, but I deal principally and primarily with Customs and one or two other matters and my colleague primarily with Income-tax.

A.2875. Officially there is no division of responsibility?—No.

A.2876. What are the functions of the Board?—To administer the revenue collecting departments of the Government of India, at least the principal revenue collecting departments, income-tax, customs, salt, excise and stamps.

A.2877. You have provided us with a short note of the evidence which you wish to put before the Commission. Have you anything in addition to that which you have written which you would like to say at this stage?—I do not think so. I am afraid this note has been prepared hurriedly as I got the Government of India's memorandum which was prepared by the Commerce Department only on Tuesday night.

A.2878. Amongst other things, I think we should like to have from you some measure of the practical difficulties involved in granting further concessions to agriculturists in the shape of free import under license or other such concessions. I take it that the principle of allowing free import under control to approved persons or firms is established in India?—I would not say that; administratively we rather dislike giving concessions to people; we prefer that the concessions should be for a particular article, no matter by whom it is imported.

A.2879. Are there no cases in which persons or firms have certain facilities granted?—Yes, there are one or two, but we would like to reduce them as much as possible.

A.2880. I take it that, broadly speaking, there is a conflict of interest between the industrialist in India who wishes to be protected and the agriculturist who wishes to import free of duty?—Yes; I suppose there is a conflict, in respect of certain articles at any rate.

A.2881. I suppose the industrial concerns are very active in pressing their case upon you?—Their case is now dealt with by the Tariff Board when they are actually asking for protection. On the other hand, the demand for free entry for an article which is manufactured out here would presumably not be given by the Government of India without considering the possibility of such a concession damaging manufacturing interests here.

A.2882. And who would speak on behalf of the cultivators in a matter of that sort?—I suppose the routine procedure would be to consult the Department of Education, Health and Lands.

A.2883. But it is a fact, is it not, that agriculture being in the main a business carried on by small and detached units, agricultural interests are not likely to be quite as vocal where they conflict with those of industrial concerns as are those of the industrial concerns?—I cannot remember any case in which a concession proposed for agriculturists was dropped on account of the existence of such vested interests.

A.2884. Take the case of nitrate of potash. Are you familiar with that? Nitrate of Potash, as you know no doubt, is used as a manure and it is also capable of being used as the raw material in certain processes of manufacture and I understand that there is a tax upon nitrate of potash imported into India?—Yes, it is subject to the general rate of duty as it is not one of the manures which have been definitely specified.

A.2885. Is that not a case in which the interest of the agriculturist is rather likely to go by default?—I am not sure that we have ever heard, until a few weeks ago, of any imports of nitrate of potash for manurial purposes. I am not sure whether we show the figures separately in our Trade Reports. It is

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produced in very large quantities in India and exported in very large quantities also.

A.2886. I do not wish to exaggerate the importance of a particular case. I am only trying to get from you the general way in which your department and the other departments concerned regard these matters?—Yes: the imports for 1920-21 were 35 cwt.; for 1922-23, 48 cwt.; 1923-24, 21 cwt.; and the next two years they were *nil*.*

A.2887. *Mr. Calvert*: What is the advantage of the import duty then if there is no import?—There is no particular advantage in this case; it has never been suggested that it should be removed from the general list. "All other articles not otherwise specified" are liable to 15 per cent duty and I think it only a few weeks ago that somebody importing some nitrate of potash alleged to be for manurial purposes asked that it might be passed free, and it was merely pointed out to him that it was not on the free list at the present moment.

A.2888. *The Chairman*: It has also been suggested to the Commission that, for instance, *berseem* (Egyptian clover) seed might be imported under proper safeguards into the country free of duty. Would that be a difficult matter to arrange?—I do not think so: but for what purpose would the safeguards be required?

A.2889. As regards *berseem* I imagine there would be no need for safeguards. I was thinking of a case where the seed might be used for feeding purposes as well as for sowing?—We should prefer to have it free altogether I think.

A.2890. You would try to avoid leaving anything to the discretion of your officers at the port?—Yes, that is so, because the institution of inquiries might be embarrassing; moreover they have not got the staff to carry out such inquiries. I think myself that probably a seed of that kind would have to be disinfected on arrival.

A.2891. Under another set of rules? It is of course imported at the moment, and the rules as to quarantine or disinfection would apply to that?—I do not know whether it falls under those rules, but Sir James MacKenna would probably know.

Sir James MacKenna: I think so.

A.2892. *The Chairman*: Do you often have laid before you representations from the Imperial Agricultural Department or Provincial Agricultural Departments?—Do they come straight before your Board?—I think we very rarely get such representations; we get representations generally from importers.

A.2893. In the present conditions of development, would you expect the interests of the cultivators as a whole to be watched by the Departments of Agriculture?—I think so. I say we do not get representations from them, but we have, I think, on a number of occasions had representations from importers asking that a particular agricultural implement might be put on the free list. Such representations are accompanied by the support of the local Agricultural Department and very often the implement in question is added to the free list.

A.2894. As regards the importation of agricultural implements your existing practice is to have a detailed list called the free list and various types,

* India produces large quantities of saltpetre and has exported annual quantities in the last 5 years ranging from 6,600 to 11,700 tons. The average price was Rs. 17 per cwt., while for the very small quantities imported (5 tons in 5 years), the average price excluding duty was Rs. 50 per cwt. It is highly likely that the imports consisted of refined saltpetre and that the importer who recently imported some for manurial purposes into Madras must have been ignorant of the fact that he could have obtained any quantity at much lower prices from the Calcutta market. The export trade has fallen off considerably in the last few years and there is no doubt traders would only be too glad to sell for industrial purposes.

are put on to that list as they develop?—Rather as they come to notice on import. These implements come under item 15 in the first part of the tariff which consists of items which are free of duty.

A.2895. And you prefer that to the alternative method of granting free import to agricultural implements, and of building up what you call a system of case-law in order to decide which implements may properly be regarded as “agricultural implements”?—Yes.

A.2896. So that there again you are concerned to ease the responsibilities of your officials?—I do not know really if we as a department or I as an ex-Collector of Customs would mind very much, but I think it is the importer really who is concerned because he does not know what duty he has got to pay unless the specific article or articles are mentioned in the list. Probably the other method in a way would tend to make these things easier for him, because if the thing was a genuine case it would get through at once instead of its having to wait for a reference to be made to the Government for a notification to be issued or for the tariff to be amended; and the tariff can only be amended ordinarily once a year.

A.2897. *Sir James MacKenna*: I do not suppose you are prepared to express an opinion on the suitability of removing the import duty on agricultural products or implements?—From what point of view do you mean: from the administrative point of view, the revenue point of view, or the protective point of view? You have got to consider all points of view. We have to consider the position at any rate from the administrative point of view.

A.2898. You are really more concerned with the application of the tariff schedule which is laid down and you cannot express an opinion on the suitability or otherwise of getting rid of a particular import duty?—We are also concerned with the tariff policy in so far as it is the basis for our revenues. I might say that the other departments of the Government of India would not initiate any change in the tariff policy without hearing our views on it.

A.2899. The particular point I wanted to put to you is that at present there is a 15 per cent duty on seedlings, plants and cuttings. I do not suppose you can express an opinion as to the advisability of getting rid of that?—I do not think we should lose very much duty as things go at present.

A.2900. *Sir Henry Lawrence*: What is the revenue from those heads?—The actual revenue is not recorded but the value of imports of living plants, including bulbs and seed for sowing, was only 1½ lakhs last year; it has varied between Rs. 40,000 and Rs. 2,00,000 in the last five years, which means a maximum revenue of Rs. 30,000 from the whole head.

A.2901. *The Chairman*: That is produced from the 15 per cent duty?—Yes, on plants, bulbs and seeds. That would exclude oil-seeds which are recorded separately. This item should really be worded “seeds not otherwise specified,” but it says “seeds for sowing.”

A.2902. *Sir Thomas Middleton*: Would it include garden seeds?—Yes, it would; that is probably what it mainly consists of. Seeds which are also grown as a crop in this country would be shown under the head of that crop I think; for instance, grain, oil-seeds or cotton seed.

A.2903. *Professor Gangulee*: Do you think power pumps should be entered in the free list? I see ordinary water-lifts, when they are constructed so that they can be worked by animal or manual power, are free?—Yes.

A.2904. But I think power pumps are not free?—No, they are 2½ per cent.

A.2905. In view of the extension of irrigation, do you think power pumps should be allowed in free?—I think we should have to enquire whether the type of pump used for that purpose is solely used for agricultural purposes or is also used for other purposes.

A.2906. I see sugar mills are free if they are worked by animal or manual power, but they are not free when they are worked by power?—Yes, I think that is probably a definite defect in our tariff.

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A.2907. If you allowed sugar mills worked by power to come in free it might facilitate groups of cultivators to go in for sugar manufacture?—Yes.

A.2908. *Mr. Calvert*: Am I correct in deducing from your answers that the levying of duty on these items such as seeds and power pumps is merely because you are forced to raise revenue and is not a question of policy?—Yes, I think that is so; I am not sure that the removal of duty on them has ever been considered. Why they were not selected to be put on the free list when the tariff was framed in 1894 I cannot say at this date. It was considered that certain items should be put on the free list in order to encourage industry and agriculture in this country, but I suppose they did not think of those particular items, and they have remained subject to the general *ad valorem* rate of duty ever since, which at that time, of course, was only 5 per cent but is now 15 per cent.

A.2909. The main reason for these items of revenue is financial stringency, not policy?—Yes, I think so, though I would not say they were definitely selected to be taxed for financial reasons but simply that their omission from the general tax was probably not considered.

A.2910. You have just issued a notification this month on dairy appliances?—Yes, we made some additions to them.

A.2911. Cheese presses have been omitted from that free list; I presume that is just an accident?—Yes.

A.2912. We have also had evidence that your department has such a soft corner in its heart for wild pigs that you have put a special revenue on wire netting of 15 per cent?—That is not a special duty; it is a general duty.

A.2913. That also is not policy; it is merely due to financial stringency?—The position with regard to steel is different from other items in the tariff; there was a specially low rate of duty on structural steel before the Tariff Board sat and considered the protection of the steel industry, and then they selected particular items for protection; but wire netting falls under neither of those heads; it was never given any special concession as structural steel, nor was it protected under the heavy protective duties; it remains under the general duty of 15 per cent.

A.2914. We have had a lot of complaints about the fumigation of plants; is that under you?—The actual fumigation process is carried out in the Customs Houses.

A.2915. The witnesses have complained of heavy losses?—I have had to enquire into complaints of this nature and I generally find it comes down to this that the damage is done not by the fumigation but by the packing and unpacking, for which the importer is responsible and not the Customs Houses; it generally is due to the fact that the importer has not made proper arrangements for packing and unpacking his own plants.

A.2916. *The Chairman*: In answer to Mr. Calvert you suggested that the absence of cheese presses from a list of dairying articles which have just been put on the free list may be a defect in that list. Apart from the merit of that particular case, would you submit a list of that sort to the Agricultural Department?—I think it is much more likely that the proposals would come from them. I can find out who did make those proposals, if you wish me to. I am sorry to say I have not the papers at the moment, but ordinarily a suggestion of that kind would probably come from the department interested in protecting a particular industry, and their list would probably be taken, subject to our being satisfied that they did not include a lot of things that were commonly used for other purposes.

A.2917. A slip of the sort suggested may occur at any moment?—Yes.

A.2918. Is there any difficulty in remedying the matter?—There are two ways of remedying it; one is to vary the tariff, which is ordinarily done only once a year by the legislature; the other is by the issue of a notification which the Government of India could do under their executive powers; that can be done at once and the concession can afterwards be embodied in the tariff at leisure.

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A.2919. Is that by Order-in-Council?—No, it is by a notification by the Government of India; the Sea Customs Act empowers the Governor General in Council to exempt any particular class of goods from duty.

A.2920. A minor alteration of the kind in question could be made in that fashion without any delay or difficulty?—Yes.

A.2921. *Mr. Kamat*: On page 339 you say that the Commerce Department memorandum contains a list of the many concessions given to the agricultural industry, but of these it may be said that "they form a patchwork of individual ideas rather than a carefully thought-out and well-balanced scheme." So, the department is according to you conscious that, after all, the present tariff is a patchwork of individual ideas?—Perhaps, that is rather a tactless criticism of the Government I have the honour to serve, but what I rather intended to indicate was that most of these concessions have resulted from odd suggestions from time to time; the suggestions have been considered and put in, but there has never been, as far as I know, since the general tariff was re-imposed in 1894 any general enquiry as to how far we ought to go in regard to assistance to the agricultural industry and what concessions we ought to give them; no comprehensive scheme has ever been framed.

A.2922. You are conscious that now the time has arrived when a comprehensive list of concessions has to be worked out and put in a schedule?—Yes; I take it that was one of the objects of the Government of India in appointing this Commission.

A.2923. In this connection also have you ever felt another need: for instance, in fixing import duties on certain agricultural machinery the spirit of the Government of India is to give concessions in the interests of agriculture?—Yes.

A.2994. But in certain cases is the object of these concessions frustrated by the railway freights? For instance, the railway freight on sugar crushing mills is very heavy as they are classed as machinery? Whose function is it to see that your object in giving concessions is not frustrated by the railways?—I do not quite follow how the concession is frustrated.

A.2925. I mean you allow sugarcane crushing mills to be free of duty?—Yes, but that does not mean that they pay any heavier railway freights than they would if they paid duty.

A.2926. By reason of classification on the railways, however, sugar crushing mills, although they could be easily carried even in a brake van, are classed as heavy machinery and charged high freight. Is not that frustrating your good intentions?—I am afraid that is a matter for the Railway Department.

A.2927. I ask you whose function it is to see that the object of the Government of India is not frustrated by the railways by wrong classification?—"The Government of India in the Railway Department" I think is the answer to that.

A.2928. Does not the Commerce Department deal both with these tariff concessions as well as with railway matters?—To the Commerce Department has been assigned the subject? Tariffs, which overlaps very largely with the subject Customs, which has been assigned to the Finance Department and is dealt with by the Central Board of Revenue. But the Commerce Department does not deal with Railways. The Commerce Member has also charge of the Railway Department, but only to that extent does the Commerce Department deal with Railways. The Member has two departments under him; one is Commerce and the other is Railways.

A.2929. But if something is wrong in connection with railway matters, is it not his function to see to it?—It is the function of his department to deal with it; he may not personally deal with a particular case.

A.2930. Assuming the object in view in import tariff has to be co-ordinated with railway tariff and some one has to prevent a good object being frustrated, whose function is it to see to it? Cannot the Commerce Member do these things?—I do not quite follow; do you mean what are his powers over his own Railway Department?

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A.2931. Certainly?—I suppose his powers are those of any Member of the Government of India over his own department.

A.2932. So that if the Commerce Department were to construct now a comprehensive scheme such as that to which you alluded in your first remarks to me, could the Commerce Member see to both these matters?—Are you trying to get at this: is there any advantage to be derived from the fact that the Commerce and Railway Departments are under the same Member? I think the answer to that is "No." I do not think the fact that the two departments are under the same Member affects the matter in the slightest.

A.2933. So that there is no hope of relief in that direction?—No particular hope in that direction, no.

A.2934. Speaking of the effect of export duties on agriculture, you have mentioned that the duty at present on rice is 3 annas a maund?—Yes.

A.2935. Have you heard any complaint that this duty is very heavy?—No, I believe it has been so for over 100 years.

A.2936. You have heard no complaints that it presses very heavily?—I do not remember hearing any.

A.2937. In the case of jute the present duty is Rs. 4-8 per bale?—Yes.

A.2938. Can you give me an idea whether jute could stand some enhancement of that duty?—I do not think the duty has reached such a height that the point of diminishing returns can be said to have been attained. But whether it is desirable to raise it any further is another matter.

A.2939. Similarly, there is a specific duty on sugar now of Rs. 4-8 per cwt.?—Yes.

A.2940. You say that is equivalent to an *ad valorem* duty of 37½ per cent?—Yes, at the present prices.

A.2941. Have you heard any complaints that it is a very high duty?—No serious complaints.

A.2942. Could not that stand a little enhancement?—Again the point of diminishing returns cannot be said to have been reached.

A.2943. *Sir Henry Lawrence*: On what price of sugar is that calculation of 37½ per cent made?—I base that on the import figures for last December.

A.2944. On the price that ruled last December?—Yes.

A.2945. I was told recently that it was about 25 per cent on present prices?—Possibly you are taking 25 per cent of the gross price. I think the present price of sugar is Rs. 18 to Rs. 19 duty paid at the ports. The 37½ per cent I have taken is the equivalent of Rs. 4-8 on about Rs. 13-8.

A.2946. That would be about 33 per cent?—Yes, taking a rough figure.

A.2947. Would you like to tell us anything about the complaints which have been made in the papers of the fact that sugar is being largely smuggled through free of duty that is through Kathiawar?—I should prefer not to discuss the matter unless the Commission wish to press it. Somewhat delicate negotiations with the Kathiawar State are in progress. We do realise we are losing a lot of duty and steps are being considered to stop it.

A.2948. Apart from the loss of your duty do you consider there is any injury to the cultivator from that importation?—I do not think there is any serious injury. It is true that duty-paid sugar is being under-sold to a small extent; but the difference in price is only just sufficient to enable it to be under-sold. At present, I think, they are finding a little difficulty in under-selling.

A.2949. It does not depress the price of *gur*?—Not appreciably, I think.

A.2950. Have you considered that?—No. It would do so, of course, if it continued. Still, as I say, we are considering steps to put a stop to it.

A.2951. You are looking at it from the point of view of loss of revenue and not from that of the interest of the cultivator; that is not your affair?—We are looking at it also from the point of view of the interest of trade in other directions. I do not think we have considered the possibility of the price of

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sugar being depressed and thereby affecting the price of *gur*. The difference in price between sugar that comes through Kathiawar and sugar that pays duty in Bombay is small compared with the annual fluctuations in the price of sugar.

A.2952. Coming to the point Mr. Kamat raised about concessions for the importation of implements, you mentioned the necessity of having a well-balanced scheme. How do you suggest that such a scheme should be prepared?—Possibly this Commission might do something in that direction.

A.2953. It will require a good deal of working out by officers in this country, will it not?—Yes. I think the Agricultural Department might consider those agricultural implements which are on the free list and make as comprehensive a list as they can of articles which they consider should be added to that list. What happens at present is that all the recent additions to that list have been the result of the importation of some new American or British invention. The importer brings it in hoping to get it through as an agricultural implement exempt from duty and finds it is not on the list and that he has to pay duty.

He makes a fuss and the question is examined and the decision comes to that it should be exempt; and so eventually another item is added to the list. That is the way the thing is done at present; but possibly when the Commission is in England they might collect a good deal of information as to types of agricultural implements which could be utilised in India. Nomenclature is rather difficult in that connection. If you look at the names of implements in this list you will see what I mean. There are things like "Cultivators" (I have never been quite sure what a "Cultivator" is), ensilage cutters, root cutters, and so on. There are various things still exempt by notification which may be added to the free-list in due course by legislation. It is always difficult to make a complete list of articles falling under a general definition and however big the list you cannot altogether avoid having several things which have been left out coming along later and claiming to be put in.

A.2954. Your suggestion is that the Agricultural Department should be called on to work out a detailed policy including, of course, the question of the free importation of seeds and plants and everything else that may be required to assist the cultivators in this country?—Yes. I think the initiative must come from them.

A.2955. *Sir Ganga Ram*: It has been represented to us by implement makers in this country that they cannot compete with foreign implements which are admitted free because those implements are made from raw materials which have paid no duty, whereas people who manufacture implements in this country have to use raw materials which have paid a high duty of 40 per cent or something like that?—Very often there is a high protective duty.

A.2956. What measures would you propose to mitigate that hardship?—It is one of the difficulties which always arises from a protective policy. Discrimination in favour of one industry is very apt to affect another adversely.

A.2957. Would you suggest anything in the way of a counter-rebate, or something like that?—As a Customs officer that is not a proposal I should like. It would be a very difficult proposal to work; it would be difficult to give a small manufacturer a thousand miles away from the port a rebate on steel he is using for manufacturing his implements.

A.2958. What are the latest orders with regard to your relations with Indian States? Do you give a rebate to them on everything they import?—No. A distinction must be made between Indian States having no sea frontier and those which have. As far as the former class is concerned, we do not give rebates except to Kashmir and Jammu, but States having a sea frontier are in a peculiar position and as far as they are concerned we have different arrangements with different States.

A.2959. Do you not think that smuggling may occur through such States?—I should think it is quite possible.

A.2960. How do you protect yourself against that?—As I told *Sir Henry Lawrence*, we are very much concerned at the moment about that particular

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danger and I should prefer not to discuss the steps we are proposing to take to stop it. However, we have the matter under consideration.

A.2961. Has your department considered any preferential arrangement by which you would charge more for imports from, say, Japan than for imports from England on chemical manures and things of that sort?—Not so far as I know.

A.2962. No preferential arrangements have yet been made?—No.

A.2963. In your list of manures you have not included sulphur. Do you charge full duty on that? That is the basis of all super-phosphates?—That is free of duty. It is not free as a manure but as a basis for manufactures.

A.2964. In the case of rice coming from Burma to Bengal is no duty charged?—No, neither an import nor an export duty.

A.2965. Does power-driven machinery for refining sugar come in as agricultural machinery?—In any case it only pays a duty of $2\frac{1}{2}$ per cent.

2966. I want to know whether machinery imported for purposes of refining sugar is classed as agricultural machinery or not?—No, not sugar power machinery.

A.2967. Do you put a tariff on fencing, Canadian fencing for example, which is used to keep out wild animals?—Yes; 15 per cent. It is the ordinary general rate of duty.

A.2968. Would you not class that amongst agricultural requirements?—It is certainly not an agricultural implement. The agricultural implement is a free item and not the agricultural requirement.

A.2969. *Sir Thomas Middleton*: In connection with the importation of salt are there any preferential duties?—No.

A.2970. What is the duty on salt coming from Aden?—Rs. 1-4-0 a maund.

A.2971. That is the same as the internal duty?—Yes.

A.2972. In connection with the salt manufacture which is in private hands in Madras and Bombay, who maintains the bonded warehouses?—The Government maintain them.

A.2973. Has any change recently been made in the handling of salt manufacture in Bombay? You remember, I think, that the Indian Taxation Enquiry Committee made a reference to the fact that changes were required?—I have seen those papers and my recollection is that after going through the matter quite thoroughly we disagreed with the Taxation Enquiry Committee's recommendations and decided that the Bombay system was as good as, if not better than, the Madras system which the Committee recommended and we decided not to interfere with the former.

A.2974. So that the position remains exactly as it was before the report of the Salt Committee of 1902 which made similar recommendations?—Yes, the position in regard to certain matters such as the method of weighing and so on.

A.2975. *Sir Henry Lawrence*: Where does the imported salt now come from?—United Kingdom, Aden, Port Said, Hamburg, Liverpool, Spain.

A.2976. Is the majority of it Continental salt?—No; I can give you the last year's figures (1925-26): United Kingdom, 104,000 tons; Aden, 135,000 tons; Germany, 40,000 tons; Spain, 48,000 tons; Italian East Africa, 51,000 tons; Egypt, 118,000 tons; French Somaliland, 14,000 tons.

A.2977. Of that, which is sea salt and which is rock salt?—Salt from Aden and Port Said is certainly sea salt and I was under the impression that German salt and Spanish salt was also sea salt.

A.2978. So only the United Kingdom salt is rock salt?—Yes; I think so.

A.2979. In which part of India is the imported salt consumed?—In Bengal, Assam and Burma.

A.2980. Is there any importation of foreign salt into Bombay?—No.

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A.2981. *Sir Thomas Middleton*: The salt which is produced in Bombay and Madras does not, I understand, meet the requirements of the consumers in Bengal, Assam and Burma?—They are very conservative buyers, I think.

A.2982. It is not merely a question of the cost of shipment?—I do not think so, no.

A.2983. It is a question of the quality of the salt?—We had a very large quantity about 2,000 tons, of Tuticorin salt lying in Chittagong for 3 years which the owner could not sell in order to pay his duty. We tried to see if we could sell it at less than the duty but there was absolutely no demand for it.

A.2984. *Sir Henry Lawrence*: It is a matter of taste?—Yes.

A.2985. *Dr. Hyder*: I understand you expressed the opinion (I was not here at that time) that the Central Board of Revenue has not accepted the recommendations of the Taxation Enquiry Committee. I suppose you refer to the arrangements for the supervision of the salt at Bombay?—Yes; I cannot claim very great intimacy with that particular matter, but my recollection is that in so far as the Taxation Enquiry Committee presided over by Sir Charles Todhunter recommended that we should substitute the Madras system for the Bombay system, we decided that we would not do that.

A.2986. May I, in reply, point out the fact that I know those salt *golas* in Bombay and I think your people in Bombay do not know how much salt there is; if I were so energetic, I could take one or two *golas* without your knowing anything about it?—Is that a fact?

A.2987. I know the Madras system is a little more elaborate and goes into details, but apart from that the Madras system is better in my opinion?—If say I do not take any personal responsibility for that decision.

A.2988. I think the Taxation Enquiry Committee also recommended that the tariff should be made subject to an examination by an expert body. Do you not think that the time is now come when the Tariff Board should go into the question of tariff item by item?—I do not think it is the business of the Tariff Board. The Tariff Board is merely there to consider giving discriminating protection to particular industries; it has nothing to do with the general tariff.

A.2989. There is no other body to consider that question in India and the only expert body the Government of India does possess is the Tariff Board?—Would you say that the Tariff Board is a body of experts in tariffs?

A.2990. I am inclined to say so. Do you think that the Commerce Department of the Government of India or the Central Board of Revenue are capable of subjecting the tariff to the minutest scrutiny?—I hope that any opinion that I may express may not be construed as committing the Government of India on the subject, but I should like to say that I do not think the Taxation Enquiry Committee made it particularly clear as regards the directions in which they wanted us to consider the revision of the tariff. We have had a great deal of criticism, and the question of revising the tariff is engaging the attention of the Government of India; but it is a matter which would be extremely difficult to deal with in this particular session with important items like the Steel Protection Bill and others coming on. Such an important measure which involves a complete revision of the tariff policy can hardly be taken up in this legislative session, but I think you may take it that the Government of India will consider, or rather are considering, what should be done in the matter; they realise that the present system is not a satisfactory one. One of the most unsatisfactory items, in my opinion, is the existence of this delightful document which I have here which has its items arranged in an entirely different order from the statutory tariff and is commonly regarded as "the" Indian tariff which it is not.

A.2991. *Mr. Kamat*: In this connection would it not be possible to appoint a committee of the legislature to revise or overhaul the whole thing by the end of the next session?—Do you think that the legislature could find a body of experts among themselves?

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The Committee may include also members who have served on the Taxation Enquiry Committee, members who have served on the Tariff Board and so on?

A.2992. *Dr. Hyder*: I may say that the idea was that the whole subject should at one time be made over to the Tariff Board, with such additional members being added to it as the Government of India might think necessary?—I understand that the Tariff Board has already a big programme before them and I do not think this general revision concerns them, nor is it in any way related to the purpose for which they were appointed.

A.2993. Coming to the note of your evidence you say on page 339: "An alternative course would be to make all agricultural implements free without specifying any by name," and so on. What difficulty is there if all agricultural implements were made free without specifying any name?—From my point of view the Collectors of Customs would have to decide whether a particular instrument was or was not free and different Collectors might decide the same question in different ways. That is really a matter in which we try to please the trade and if you listen to what the Chambers of Commerce have to say on the subject they would prefer to have the articles definitely specified rather than included under a vague item. I am not prepared to say that it would be better from their point of view, but that is what they themselves say.

A.2994. Taking the case of hand rice-hullers, they are not definitely specified in the schedule and they are subject to duty. My point is this: You say that a body of case-law would grow up round the item and the Chambers say that the case-law is not available. Now take the case of your Income Tax Act. Round about that Act there has grown up a body of case-law, is not that so?—Yes, I suppose so.

A.2995. And you issue the rulings. Is there any difficulty there? Why should not the same procedure be followed in the case of agricultural implements?—I say the Associated Chambers have complained about it. I do not personally say that their complaint is a good one, but they have complained. I think it is for you to consider which you would rather have, certainty or uncertainty.

A.2996. What is your opinion?—As a Customs Officer I would rather have it specific. I should then not have to consult somebody as to whether a particular thing can be used for any other purpose.

A.2997. Is saltpetre imported free, or is it subject to any duty?—I said 15 per cent; we have already discussed that I think.

A.2998. What is the reason for saltpetre being subject to a duty of 15 per cent?—Because it has not been exempted from it. All articles not otherwise specified are subject to a duty of 15 per cent.

A.2999. Is that not specifically exempted?—As I have already stated before, it is very rarely imported and I do not suppose it has occurred to anybody to exempt it.

A.3000. The reason generally given is that it might be used for the manufacture of gunpowder; but surely its agricultural use predominates?—I think I quoted the figures: about 5 tons of saltpetre had been imported in five years so that could hardly be contended that it would have been prejudicial to the interests of the Government if it were put on the free list.

A.3001. The point in my mind is that there is no reason for the existence of this duty of 15 per cent on seedlings, plants and cuttings, because they might be used to improve agriculture?—The Commerce Department gave you, in their note, a list of the things which were free and all I tried to do here was to let you see exactly how far the concessions we at present give fall short of the concessions on all the things which could be conceivably used for agriculture; that is why I have merely mentioned one or two things here on which concessions are not given, not that it has been decided not to give concession but that probably it has not been considered. The concessions we have given have come up one by one and after having been considered they have been either put on the free list or rejected.

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A.3002. Would you not like the Government of India in the Commerce or Finance Department to take the help of the Agricultural Adviser who would be in a better position to tell you whether a certain implement is for agricultural use or not?—It is our usual practice to consult him.

A.3003. Is this duty on sugar which works out to 37½ per cent protective or revenue?—Revenue.

A.3004. *Professor Gangulee*: Would you favour the idea of including scientific apparatus, such as microscopes, in your free list?—I think we might include particular scientific instruments. I think it would be rather dangerous merely to say that all scientific instruments should be free. If we did so we should be faced with a series of arguments as to what was and what was not a scientific instrument.

A.3005. For instance, scientific apparatus would be necessary to equip Government agricultural colleges or research stations and so on?—I do not think that the exemption of a limited number of particular items such as microscopes as suggested by you would seriously affect our revenues. But I do think that it would be dangerous to say that all scientific apparatus should be exempted. In that case Messrs. Tata and Sons, for example, might come forward and say that the whole of their plant consisted of scientific apparatus and ask for that to be passed free.

A.3006. When I suggested scientific apparatus I meant things which were utilised in the laboratories for experimental purposes?—Our difficulty would be to find a satisfactory definition.

A.3007. In putting the various agricultural implements and manures on your free list, do you know of any suggestions which came from the Agricultural Department, either Imperial or Provincial, in this matter?—Yes, I think some of them did come through them.

A.3008. Is it your practice to consult the Provincial or Imperial Agricultural Departments in these matters?—Yes. As I said the initiative is generally taken by the importer who, if he finds he has to pay a duty on a particular thing, applies to the Collector of Customs, and the latter after satisfying himself that the case is a genuine one, sends it on to the Government of India who in their turn consult the Agricultural Adviser.

A.3009. *The Chairman*: Could you let us hear whether cheese presses were excluded from the tariff schedule on the initiative of the Agricultural Department, or in consultation with them?—The Inspector-General of Agriculture on the 1st of February 1904 wrote to the Government of India thus: "I have the honour to suggest that dairy machinery of every description should be exempted from import duty for a very large trade in butter and milk products is developing. The industry affects the agricultural community. Cream separators are largely used in remote villages." Then he was consulted unofficially and he said in reply: "Many dairy appliances which are imported as such can be used for other purposes and it is unlikely that the Finance Department would allow the inclusion of such a thing in the free list. It is unnecessary perhaps to press for their inclusion as with native enterprise they could in many cases be made in the country. I send herewith a complete catalogue of dairy appliances and machinery which shows how great the variety is. We might press for including the following in the free list: Cream separators, milk sterilizing or pasteurising plant, milk refrigerators, churns, butter driers and butter workers." I do not know whether you have this list.

A.3010. *Mr. Calvert*: It was in 1907, was it not?—No, that was the addition of milking machines to the list.

A.3011. *The Chairman*: I wonder whether these additions were considered by the Agricultural Department?—Those six items were the last that the Inspector-General of Agriculture sent up; they did not include cheese presses and apparently no one has ever asked for cheese presses to be included since.

A.3012. In a case where your department took the initial steps would you automatically, as a matter of office routine, submit a suggestion of that sort

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to the Agricultural Adviser?—Yes, I think the Government of India would always consult him.

A.3013. *Sir Thomas Middleton*: You mentioned just now the case of the importation of Tuticorin salt which was unacceptable to the Bengali consumer. I think it is well-known that Bombay and Madras salt does not go into Bengal or Burma?—A certain amount of Bombay salt does go into Bengal but the salt is rather of a dirty brown colour.

A.3014. I was going to ask you whether you have any information about Northern India salt, does it go into Bengal?—Not very much I think.

A.3015. Is it because of the carriage or because of the quality?—I think probably it is both now. As I say the Bengali is conservative; he has got used to a particular class of salt and he does not like to change it, and I imagine also that the railway freight must be a serious consideration in this matter.

(The witness withdrew.)

The Commission then adjourned till 10 o'clock on Tuesday, the 22nd February 1927.

Tuesday, February 22, 1927,

DELHI.

PRESENT :

Sir HENRY STAVELEY LAWRENCE, K.C.S.I., I.C.S. (*Chairman*).

Sir THOMAS MIDDLETON, K.B.E.,
C.B.
Rai Bahadur Sir GANGA RAM, Kt.,
C.I.E., M.V.O.
SIR JAMES MACKENNA, Kt., C.I.E.,
I.C.S.

Mr. H. CALVERT, C.I.E., I.C.S.
Professor N. GANGULEE.
Dr. L. K. HYDER.
Mr. B. S. KAMAT.

Mr. J. A. MADAN, I.C.S. } (*Joint Secretaries.*)
Mr. F. W. H. SMITH. }

**Dr. D. B. MEEK, M.A., D.Sc., O.B.E., Director General of
Commercial Intelligence and Statistics.**

Memorandum on Agricultural Statistics.

The most convenient starting point for a history of Agricultural Statistics in India is the despatch of the Secretary of State No. 25-R., dated 4th May 1882, with which were forwarded a set of agricultural tables compiled by the India Office, from the statistical information furnished in provincial land revenue returns and Administration Reports. The course of compilation had revealed the fact that greater uniformity in the method of compilation and greater accuracy were necessary, and the Government of India were asked to effect such changes in the forms as would enable information of a uniform character to be compiled for All-India. The matter was considered at a Statistical Conference held in 1883, and revised forms and instructions were issued to Local Governments and Administrations; it was also decided with the approval of the Secretary of State that the Revenue and Agriculture Department, one of whose duties had been defined to be "the more complete and systematic ascertaining and rendering available of the statistics of vital, agricultural and economic facts for every part of India, in order that Government and its officers may always be in possession of an adequate knowledge of the natural condition of the country, its population and its resources," should undertake the compilation and publication of these statistics. Accordingly, the Agricultural Tables relating to India were compiled and published for some years by that department. Other departments of the Government of India were also publishing statistics relating to subjects under their control, but it was soon felt that the disconnected manner in which Indian statistics were being compiled and issued by various departments of the Government of India seriously detracted from their value and that their intelligent examination, collation and interpretation were necessary to render them as useful as they might be. In 1895, a Statistical Bureau was therefore formed under an independent officer with the designation of Director General of Statistics; and the statistical work of the departments of the Government of India was entrusted to him. He was to compile and publish the statistics in his name and on his responsibility, but

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under the general guidance and control of the department concerned. This arrangement continued till 1905, when the Statistical Branch was merged in the new office of the Director General of Commercial Intelligence. After a few years it was felt that the two departments of Statistics and Commercial Intelligence could not, consistently with efficiency, be combined under a single officer. In 1914, a separate Department of Statistics was therefore created. But this separate arrangement was short-lived; in December 1922 the Department of Statistics was amalgamated with the Commercial Intelligence Department.

2. *Agricultural Statistics, Volume I.*—The statistics compiled by the India Office referred to above, briefly stated, dealt with the total area of each Province and district, the cultivated area and waste lands, the latter head being further sub-divided into culturable and unculturable, the area occupied by the principal crops in each Province and district, and the incidence of land revenue per head of population and per unit of cultivated area. The chief defects which were noticed at the time of compilation by the India Office were, firstly, that the figures under the same heading did not always mean the same thing in all the Provinces, and secondly that only a little more than two-thirds of British India was brought under the scope of the returns. To illustrate the first point, "cultivated area" in most Provinces correctly included areas under cultivation which were not assessed to land revenue, but some Provinces excluded such areas from the area under cultivation, and showed them under area unculturable, as information regarding those tracts was not available with the revenue agency. Again, in most Provinces "cultivated area" meant the area actually under the plough, but in others it included pasture, meadow, and fallow lands in occupation. The value of the statistics was seriously impaired also by the second main defect noticed, viz., that the returns did not include all parts of even British India. Thus Bengal which has no revenue agency in each village was completely left out of the returns; the same was the case also with the permanently settled tracts of other Provinces, and with the area of the Indian States, both within and outside the British Provinces. The subsequent history of agricultural statistics in India is a record of the attempts made to introduce uniformity and comprehensiveness in the returns for each Province and to improve the manner of their compilation and presentation. The subject was discussed at various committees and conferences, but progress had to be slow, for the problem was limited by the varying requirements of the revenue systems obtaining in different Provinces. The provincial needs were obligatory, since the revenue system demanded that certain items should be kept separate or grouped together; the requirements of statistics had therefore to be limited by the exigencies of administrative convenience. The statistics are therefore a compromise between what is ideally desirable and what is actually attainable. The notes and appendices in the agricultural statistics volume indicate how far it has been possible to evolve a uniform system.

3. *Development.*—It would be unnecessary to trace the progress achieved till now in the improvement of these statistics except in the briefest manner. The forms now used in agricultural statistics are practically those prescribed in 1891; Appendix II shows the chief additions or changes made from time to time. The principal of these may be mentioned here for convenience. Beginning from the volume for 1894-95 the table on "Price of Produce" was discontinued, other arrangements having been made to secure a record of prices. From the volume for 1896-97 a summary table was introduced at the beginning showing the figures for British India relating to each table for a series of years. From 1901-02 the table on "Varieties of Tenure" was abolished. Beginning from the volume for 1912-13 the summary tables were expanded and a table on world crops added. A series of charts was also introduced from that time to illustrate the trend of the development of agriculture. With effect from 1919-20 the table on "Transfer of Land" was abolished, and a new table on "Harvest Prices" introduced; in addition

the table under "Classification of Area" was amplified and the area under "Irrigation" shown separately.

4. When the tables were first prescribed it was intended that they should be restricted to areas for which accurate returns were obtainable, i.e., to areas which possess a field-to-field record and a village staff, the area for which no returns exist being eliminated by deduction from the total. The area shown under the latter head was not inconsiderable, and it was felt to be a serious defect in the statistics. The first exception to the above principle had to be made in the case of Bengal, which in the absence of survey and village staff, must otherwise have remained a total blank in the volume. The principle was therefore introduced of admitting estimates based on local enquiry and knowledge. There were, however, gaps still, and in 1906 the Government of India asked other Local Governments to follow for those tracts for which accurate information was not available, the system already adopted by Bengal. At present, therefore, we have complete statistics for the whole of British India based on actual measurements and supplemented by estimates. These estimates are improving in accuracy with the progress of cadastral surveys.

5. From the very outset figures for both Provinces and districts were shown in the tables. From the volume for 1921-22 the district figures have been abolished altogether as a measure of economy. The number of years for which figures were shown has varied from time to time. At present the provincial figures are confined to the last five years.

6. The period to which the returns of agricultural statistics referred was not for a long time the same in all cases. In some Provinces they referred to the financial year and in others to the agricultural or revenue year of the Provinces. In 1919 the returns were brought on to the same period for most of the Provinces, the year ending 30th June being adopted as the agricultural year. The exceptions are the Central Provinces and Assam, who prepare all their returns for the year ending 31st May and 31st March respectively, and Bombay, which prepares returns relating to the table on land revenue for the year ending 31st July.

7. *Agricultural Statistics, Vol. II.*—The earlier issues of *Agricultural Statistics* incorporated figures relating to such Indian States as furnished the reports. The statistics for the Mysore State were available from the very beginning. Gradually such other Indian States as had the requisite agency to collect the statistics began to supply figures regarding their States, and it was soon found necessary to deal with them in a separate section (Part II) of the volume. By 1904, the number of reporting States had sufficiently increased to justify a separate publication regarding Indian States, styled *Agricultural Statistics, Volume II*. Efforts have been made at various times to increase the number of reporting States, but the returns are purely voluntary, and there is still a considerable area which is not included in the publication. The statistics are also far less accurate and complete than those of British Provinces.

8. *General.*—The statistics of area as far as British Provinces are concerned are, on the whole, fairly accurate, and there is little scope for improvement. In most of the Provinces there exist a field-to-field record and a village staff, capable of reporting the area under crop with great accuracy. For permanently settled tracts, however, (Bengal, Bihar and Orissa, parts of Madras, the United Provinces and Assam) where the figures are based on estimates, and not measurements, the statistics are not as reliable. Another source of error in the area figures is the practice of mixing two or more crops in the same field; the respective areas under different crops have, in such cases, to be based on estimates.

9. *Livestock.*—The collection of statistics regarding livestock was undertaken at the instance of the Secretary of State. The forms in which they were to be furnished were laid down at the Statistical Conference of 1883, and these statistics have been regularly published in Volume I of the *Agricultural Statistics*. They are now based only on the results of annual or

quinquennial censuses, but when they were started, there was the same difficulty regarding permanently-settled tracts as in the case of area statistics, viz., the absence of an agency to collect the figures. Even in Provinces which possessed the necessary organisation the statistics were far from accurate as in some cases a census was completed only within the course of three or four years. Nor were the methods of enumeration free from defects. Some Provinces again took an annual census while others had a quinquennial census. The livestock figures of Bengal had to be estimated till 1912-13 when the Province took its first cattle census. In Bihar and Orissa a census was taken in 1913-14. But still the methods of collecting the data were not uniform, nor were they collected at the same time for all the Provinces. In 1916, the Government of India after consulting Local Governments and Administrations decided that a general census of cattle should be taken throughout British India between December 1919 and April 1920, and that this census should be repeated quinquennially. The co-operation of Indian States was also invited and several States took part. The results were published in a pamphlet form in 1921. From 1919-20, therefore, the statistics can be regarded as more satisfactory, but, except in the case of Provinces which take an annual census, the figures have to be repeated till the census is taken again at the end of the quinquennium. At present the Central Provinces, Manpur* and Burma take the census annually. The second census has taken place in all the Provinces but not at the same time, as Bengal, had, owing to financial stringency, to postpone it till 1926, while, on the other hand, the Punjab carried it out before the end of the quinquennium. A larger number of Indian States took part in the second census.

10. *Tea Statistics*.—Special Statements regarding tea, coffee, cinchona and cotton cultivation in British India and Indian States used to be compiled by the Department of Finance and Commerce and published in the volume "Statistical Tables relating to British India." The statistics of the production of tea which related to the calendar year were obtained from the owners and managers of tea estates through the district officers in forms prescribed for the purpose. The method of collection is at present the same but considerable improvements have been effected in these statistics through the help of non-official bodies like the Indian Tea Association and the United Planters' Association of Southern India. Where no reports are received from estates, estimates are made by local officers but before accepting these estimates this department makes a further attempt to obtain the actual returns by direct correspondence with the non-reporting estates and in many cases, with successful results.

11. *Coffee Statistics*.—The early history of these statistics is the same as that of tea. The methods of collecting the information are also the same. Originally the statistics related to the calendar year but in 1909 it was decided that these statistics should be prepared for the year ending 30th June which corresponds fairly closely to the coffee year. The change took effect from the statistics for 1908-09 which were issued in 1910. There were no issues for the years 1910-11 to 1918-19 as it was felt that the information supplied was very inaccurate. The statistics have been renewed with effect from 1919-20 in a slightly improved form. They cannot even at present be said to be very satisfactory and much improvement is possible in the accuracy of these statistics. As a record of total production of coffee in India they are defective in that they do not include plantations of less than 10 acres.

12. *Rubber Statistics*.—The first statement regarding rubber production published by this department related to the year 1919. The form and the methods of collection are practically the same as in the case of tea and coffee.

Tea, Coffee and Rubber statistics now appear as supplements to the *Indian Trade Journal*.

13. *Quinquennial Report on the Average Yield of Principal Crops*.—A provisional report on the yield per acre of the principal crops cultivated in

* Manpur parghana.

India was first compiled in 1892 from various statistical publications available at the time, such as Agricultural and Settlement Reports, Crop Forecasts, Gazetteers, replies to the enquiries of the Famine Commission, etc. It was decided that these estimates should be revised periodically and for this purpose a system of experimental crop cuttings was prescribed. These experiments are the basis, though not in every case the sole basis, of the revision of the standard estimates. The instructions for the preparation of these returns are that the estimates given should be that of the average outturn on average soil in a year of average character as deduced from considerations of the information obtained or experiments made during the period under review; so that the estimate of the average yield multiplied by the area might give an approximation to the total yield of crop in an average year. The results of the revision of the estimates are published at the end of every five years. If during the period under review, there were exceptionally good or bad seasons, the fact would not necessarily affect the standard estimates unless there are reasons for believing that the figures previously adopted as estimates of average yield in an average year were fixed either too high or too low. The chief object of quinquennial reports is not so much to show the outturn per acre during the particular period as to help in arriving at what may reasonably be considered as a normal outturn in a year of average crop. Separate estimates of yield are generally maintained for irrigated and unirrigated tracts. The average yield in each district as well as for the Province, is given in the publication.

14. Crop cutting experiments have till lately been made generally by the District Revenue staff. In 1913, on an examination of the reports of the quinquennium ending 1911-12, it was recognised that the results of the experiments as conducted by the district revenue staff were generally unreliable. A change was accordingly made in 1915 and instructions were issued by the Government of India, to employ, as far as possible, expert officers of the Agricultural Department in the conduct of these experiments. The new system was introduced in the quinquennium beginning 1916-17 mainly as an experimental measure, but in the majority of provinces the change could not be fully carried out, principally owing to insufficiency of staff in the Provincial Agricultural Departments. These experiments, if they are to yield reliable results, should be carried out in larger numbers and under the supervision of trained officers of the Agricultural Department.

15. *Crop Forecasts.*—The Statistical Conference of 1883, referred to previously, also discussed the question of issuing crop forecasts for the information of the public. They recommended that the Agricultural Departments should endeavour to give the public an early forecast of harvest prospects of crops of commercial value. The Government of India accepted these views and commended the proposal to the consideration of the Local Governments and Administrations. About the same time the Secretary of State, at the instance of a leading Liverpool firm interested in the wheat trade, recommended the publication of information regarding crops in India somewhat on the lines adopted by the United States of America Department of Agriculture. Accordingly in 1884 the Government of India issued a circular letter to Local Governments and Administrations requesting the preparation of forecasts of the wheat crop. It was also stated in the circular that the experience gained in attempting to secure continuous information as to the character of the wheat crop would lead the Directors of Agriculture to formulate and perfect a system applicable to other crops of commercial importance. In the following year, after considering the views of Local Governments, the Government of India issued orders to the Provinces concerned, to extend the forecasts to cotton, oil-seeds, rice and jute on the system adopted for wheat. Detailed instructions regarding the preparation of forecasts were also issued in continuation. This was the beginning of crop forecasting in India. At present forecasts are issued for the following crops—cotton, jute, wheat, rice, sugarcane, winter oil-seeds (rape and mustard and linseed) sesamum, ground-nut, castor and indigo. Of these the jute forecasts

are now issued by the Director of Agriculture, Bengal, and the method of estimating the outturn is also not the same as in the case of other crops.

16. The framing of an estimate of the outturn of a crop depends on three factors:—the area, the standard normal outturn per acre, and the condition estimate.

(i) *Area*.—As regards area it has already been noticed that in villages of most Provinces there exists an agency capable of reporting the acreage of crops with accuracy wherever fields have been mapped and surveyed. In respect of permanently settled tracts and areas under mixed crops, the statistics are not as reliable.

(ii) The second factor is the normal outturn per acre. It has already been noticed that the department entrusted with crop forecasting work in each Province maintains a record showing the average yield per acre of principal crops based mainly on the results of crop cutting experiments.

(iii) The third factor is the condition estimate, i.e., the fraction representing the relation of the crop reported on to the normal crop per acre. This estimate is in the first instance framed by the Village Accountant or *Patwari*, as he is called or an official of similar standing by means of "anna notation," i.e., the condition of crop is estimated to be so many annas higher or lower than the normal crop. The anna notation, however, does not follow a uniform standard in all parts of India for, in certain tracts 12 annas may represent a normal crop while in another 16 annas may represent the normal. Owing to this diversity of practice in different tracts it was considered advisable to use the American system in the published forecasts under which 100 denotes the normal yield. The *Patwaris*, however, are allowed to follow their own method as it is considered that the introduction of a new system will only confuse the estimates made by them, but the anna notation is converted into a percentage estimate according to the American system either by the district officers or by the provincial forecasting authority.

17. It will be seen from the above that the total yield of a crop is estimated by multiplying the three factors—the area, the condition estimate and the standard yield. Of these factors only the area figures can be regarded as fairly accurate. It has been recognised that there is often a not altogether negligible margin of error in the estimates of the condition and the standard yield. Even a very small error in either of these two factors would put the total estimates of yield far out inasmuch as the small error is multiplied by the area which is a large figure. The defects of the standard yield have already been noticed. The condition estimate is, in the first instance, prepared by the *Patwari* or village official who, being generally untrained and pessimistic by nature, is hardly able to form a correct estimate of outturn in terms of the normal crop. His idea of a normal crop is, that which he longs to see but rarely sees and the result is that the standard with which he compares a crop is really something above the normal. Consequently his estimates generally fall below the mark.

18. The Board of Agriculture at a meeting held in 1919 suggested that at the end of each season the "actual" outturn of crops should be determined by the collection and detailed study of statistics of movement by rail or sea, of manufacture, or of any process such as baling, and of estimates of local consumption. The average of the actual outturn thus obtained for a series of years divided by the corresponding area should represent the standard yield on which calculations should be made. As regards the condition estimate the *Patwaris* should be left to follow their traditional policy, but their estimates should be corrected in the light of past experience. Thus if the *Patwaris* reported during the last 10 years—

- 2—8 anna crops,
- 2—9 anna crops,
- 2—10 anna crops,
- 2—11 anna crops, and
- 2—12 anna crops,

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it is a fair inference that when he sees an average crop he calls it a 10 anna crop and that when he reports a 11 anna crop, the crop is a little above the average. The *Patwari's* estimate should, therefore, be corrected in the light of a more correct conception of the normal. This correction of condition estimate can be done without difficulty. The standard yield however cannot be calculated, as suggested, for the simple reason that the determination of actual yield is beset with great difficulties. It would be difficult to estimate the amount of consumption or stocks, and the difficulty is greater in the case of food-crops than of non-food crops. In the case of cotton an attempt is made to determine the actual production by adding together the exports, the amount consumed in mills, and a conventional estimate of local consumption. The quantity of cotton consumed in Mills in British India is calculated from the amount realised under the Cotton Cess Act while for Indian States an estimate is made based on the quantity of goods produced in mills in such States. We have also returns of cotton pressed in British India and these returns, which are compulsory under the Cotton Ginning and Pressing Factories Act, are compiled and published weekly in the *Indian Trade Journal*. If these figures could be supplemented by the figures of loose cotton received in spinning mills, an estimate of actual production could be made, but there are at present no means of ascertaining the latter figures while the absence of information about Indian States would be another difficulty. In the case of other crops there is not even as much data to go on, and trade figures, without reliable figures of consumption, will not therefore serve the purpose of ascertaining the total yield. The Indian Sugar Committee, 1920, were definitely of opinion that the method is not applicable in the case of sugarcane and the Board of Agriculture while reviewing the subject again in 1924 emphasised the fact that crop cutting experiments must remain the basis of the standard outturn.

19. *The manner of publishing Forecasts.*—The general practice is to issue a preliminary forecast, a second estimate and a third or final estimate, fuller and more precise in data than the first two forecasts, as in the case of rice, oil-seeds and sugarcane. There are two additional forecasts for wheat and cotton and one for sesamum. On the other hand, only two forecasts are made of the jute, ground-nut and indigo crops and only one of the castor crop. The provincial forecasts are published as soon as they are ready by the department entrusted with the work, but advance copies are usually sent to this department for the purpose of preparing the All-India Memorandum. It often happens that the All-India forecasts are not ready for issue owing to non-receipt of some of the provincial returns and in such cases, the provincial returns are published in advance in the *Indian Trade Journal*.

Besides regular forecasts, monthly intermediate crop reports have been introduced from 1925, to be issued in the interval between the forecasts. These reports are mainly based on the expert opinions of provincial authorities and give no details but confine themselves generally to the effect of the season on the estimate of the condition of the crop since the last regular forecast. These reports are published in the *Indian Trade Journal* as soon as they are received from each provincial authority.

20. *Estimates of Area and Yield of the Principal Crops in India.*—This publication is mainly a summary of the forecasts issued during the year in a connected and convenient form. The history of this publication is therefore the same as that of crop forecasts. It is being published as a Blue Book. Its object is to show as soon as possible the best estimate available of the outturn of the principal crops during each season with general remarks about the character of the season. The latest year's figures given in the publication are provisional while the preceding year's are the corrected estimates. Owing to the difference in the methods of preparation of this volume, and that of Agricultural Statistics, the area under the same crop for the same year reported in the two publications have not always agreed. A detailed examination of the causes of discrepancy was made in the Department of Statistics and instructions were issued to local authorities to reconcile the

two sets of figures in future. Discrepancies however still continue to occur and the Indian Sugar Committee while reviewing the Agricultural Statistics pointed out this defect.

21. In the foregoing sections the publications on agricultural statistics issued by this department have been reviewed. The difficulties experienced in collecting the statistics have also been incidentally noticed. In the case of Agricultural Statistics, it has been observed that, so far as British Provinces are concerned, the area statistics are fairly reliable except in the case of tracts which have no revenue agency to report the statistics; the progress of the cadastral survey in these tracts has materially helped the district authorities to improve their estimates, but so long as the figures are based on conjecture, they cannot be as accurate as the statistics obtained from actual measurement. The practice of mixing different crops in the same field is another source of inaccuracy, the estimation of separate areas under each crop being based on formulæ adopted by each Provincial Government. In the case of Indian States the statistics are neither complete nor do they appear to be very accurate; and any improvement is conditioned by their willingness or ability to furnish reliable statistics. Some States make a serious effort to improve the statistics, but many have not got the requisite agency to collect them. The statistics relating to tea, coffee and rubber are obtained from the plantations, and both their completeness and accuracy must depend on the co-operation received from the managers of estates. The figures regarding tea are believed to be much more reliable than those relating to coffee. The statistics for coffee are also less complete inasmuch as they do not include the figures relating to small plantations. It has also been noticed that the "standard yield" of crops on which estimates of production are based are defective as the crop-cutting experiments on which they are mainly based have not been conducted either in sufficient numbers or with sufficient care. The limitations of our crop forecasts have been fully dealt with above; the principal lines along which improvements could be effected would appear to be (1) by a careful interpretation of the estimates of the condition of crops reported by the primary reporting agency, and (2) by the attainment of greater accuracy in the estimates of the "standard yield."

22. The publications on agricultural statistics serve a two-fold purpose. They are primarily meant for the information of Government, for no Government can afford to be ignorant of its agricultural resources, and secondarily they are meant for the information of the trade and the public. The trade is naturally more interested in forecasts of production than in the statistics of actual area or estimated production published long after the harvest is realised, for it is of the utmost importance to the trade to obtain a reasonably correct estimate beforehand of the quantity of agricultural produce it will have to handle. The chief, if not the only, use of the volumes of Agricultural Statistics is as a work of reference, showing the progress of cultivation in the country. They do not enable an estimate of total agricultural production to be made, for the area is not separately specified for all the minor or the unimportant crops, nor have standard yields from which production in an average year can be worked out been estimated for them. The estimated production of the principal crops alone for each year is given in the Estimates of Area and Yield.

23. The chief feature revealed by a study of the development of agricultural statistics in India is the fact that there has been no separate agency for collecting the statistics as such, and that the work has, from the beginning, been mainly performed by the revenue agency which was already collecting statistical information for their own purposes. This dependence on the revenue agency has obviated the necessity for any separate agency, and it is extremely doubtful whether a separate organisation could have been created in a country like India owing to the enormous expense of the undertaking. But, as already noticed, this association with the revenue system has sometimes stood in the way of strict uniformity. The policy of the

Government of India has all along been to interfere as little as possible with provincial revenue arrangements consistent with the minimum requirements of statistics and no departure from this policy is perhaps at present possible or advisable. The direction in which much could be done in the way of co-ordination and uniformity without interfering greatly with the revenue arrangements, is in crop forecasting. The work of submitting estimates of outturn is now being carried out in most of the Provinces by the Departments of Agriculture, though the raw material on which they are based continue to be supplied to a great extent by the revenue staff. The Agricultural Departments, however, are unable, in many cases, through paucity of staff, to devote as much attention to the subject as is necessary and the question turns primarily on finance. But it would be desirable if the experience gained in different Provinces could be compared periodically so that suggestions for improvement could be laid before Provincial Governments to be adopted so far as provincial conditions permit. The conditions affecting a crop or its outturn is as much a matter of All-India as of provincial importance; and the All-India figures can gain in accuracy only if all the Provinces fall into line as regards improvement in the methods of forecasting.

24. *Staff*.—The section dealing with Agricultural Statistics consists at present of seven men, but of these only five are exclusively engaged on Agricultural Statistics. One man is engaged on the cotton press returns, and the other is attached to the section only for 8 months in the year. The section is in charge of a Superintendent, who, however, has other branches as well to supervise. Two of the clerks are on the scale of 100—10—200 and the others on Rs. 50—3—125. The total average cost of staff, excluding supervising staff, is nearly Rs. 11,000.

APPENDIX I.

List of Agricultural Publications with the nature of information contained in each.

Publications.	Nature of information.
1. Agricultural Statistics of India (Annual), Volume I.	Total area (in acres), classification of the area (in acres), area irrigated and crops irrigated, area under crops and specification of crops, livestock, ploughs and carts; land revenue assessment on the area, and population, harvest price of certain important crops, average yield (lbs. per acre) of principal crops in each Province of British India and Mysore in the form of appendix.
2. Agricultural Statistics of India (Annual), Volume II.	Relates to Indian States.
3. Summary tables of Agricultural Statistics (British India).	This is now issued as a supplement to the <i>Indian Trade Journal</i> published in advance of Volume I of Agricultural Statistics. Deals with all the main heads contained in Volume I except those relating to livestock, land revenue and harvest prices.
4. Report on the Census of livestock, ploughs and carts in India (Quinquennial).	Number of livestock, etc., in India as ascertained by census held quinquennially (started from 1919-20) together with comparative figures for foreign countries.
5. (i) Indian Tea Statistics (ii) Indian Coffee Statistics. (iii) Indian Rubber Statistics.	These publications are now issued annually as supplements to the <i>Indian Trade Journal</i> . The information contained in them is of the following nature:—number and area of plantations, production (in lbs.) of manufactured tea, of cured coffee and of dry rubber; labour employed in all three industries; trade figures. Besides the above the following are given:—stock of dry rubber (in lbs.), quantity of tea available for consumption in India, prices, freight, duty, cess, capital and wages, etc., relating to the tea industry.
6. Quinquennial Report on the average yield per acre of principal crops in India (Quinquennial).	Average yield (lbs. per acre) of principal crops irrigated and unirrigated—in each Province and district of British India and in Mysore.

Publications.

Nature of information.

Crop Forecasts.

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| <p>7. All-India (29 in number) Provincial Forecast. Intermediate reports.</p> <p>8. Estimates of Area and Yield of the Principal Crops in India (Annual).</p> <p>9. Weekly Cotton Press Returns</p> <p>10. Crop Atlas of India</p> | <p>. Published in the <i>Indian Trade Journal</i>. Deals mainly with area, weather conditions affecting the growth of crops, estimates of outturn, etc. Information regarding crops of foreign countries also appended.</p> <p>Area, total yield and yield per acre of principal crops during the year and for the previous nine years, standard or normal yields per acre of crops for which forecasts are prepared. Area and yield of certain principal crops in foreign countries; normal and actual rainfall (in inches) in each meteorological sub-division in India, Charts, etc.</p> <p>Statement of Cotton pressed in different Provinces in British India published weekly in the <i>Indian Trade Journal</i>.</p> <p>This is an occasional publication and contains sixteen maps showing the distribution of principal crops, viz., rice, wheat, barley, <i>jowar</i>, <i>bajra</i>, sugarcane, tea, coffee, tobacco, cotton, jute, linseed, rape and mustard, sesamum, ground-nut and indigo in different districts of India based on statistics of area. The average area and production of each Province and important ports of shipment have also been indicated with percentage share of the ports.</p> |
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APPENDIX II.

Statement showing the changes made from time to time in the forms of Agricultural Statistics.

1866.	1884.	1891.	1910.
IA. 1.—Area cultivated and uncultivated.	A.—Area cultivated and uncultivated.	A (1) Total acreage.	I.—Total acreage.
		A (2) Classification of area including irrigation).	II.—Classification of area.
			III.—Area under irrigation and crops irrigated.
IIID. 1.—Crops, cultivated	B.—Crops cultivated.	A (3) Area under crops.	IV.—Area under crops.
			V.—Livestock.
IIID. 2.—Agricultural stock	IIID. 2.—Agricultural stock.	A (4) Agricultural stock.	VII.—Harvest prices.
IIIE. 1.—Prices of produce.	IIIE. 1.—Prices of produce.	B.—Prices of produce continued from 1894-96).	VI.—Incidence of land revenue on area and population.
IE. 2.—Surveyed and assessed area.	C.—Surveyed and assessed area.	C.—Incidence of land revenue on area and population.	Discontinued from 1901-02.
IE. 3.—Varieties of tenure held direct from Government.	IE. 3.—Varieties of tenure held direct from Government.	D.—Varieties of tenure held direct from Government.	(Discontinued.)
IE. 4.—Varieties of tenure not held direct from Government.	(Discontinued.)	(Discontinued.)	(Discontinued.)
IE. 5.—Register of transfers.	IE. 5.—Register of transfers.	E.—Register of transfers of landed property.	(Discontinued.)
IIID. 3.—Rates of rent and produce,	(Discontinued.)	(Discontinued.)	(Discontinued.)

Replies to the Questionnaire.

QUESTION 1.—RESEARCH.—The general problem of agricultural development in India is the raising of the standard of efficiency of production from the soil and the standard of quality in the livestock of the country. These involve first research work under Indian conditions; and second, application of the results of research to actual production. If the research work is going to be other than dangerous it must be carried out by men who are highly qualified and who are specialists in each particular line. It further involves expensive equipment and in view of the great number of problems requires a large staff of workers. The expense involved in such research work eliminates the possibility of its being carried on efficiently by each Provincial Government. The research work should, therefore, in my opinion, be co-ordinated and carried out by staff directly under the Government of India a staff which should be freed from the executive action of demonstration and propaganda for the purpose of applying the results of research. The executive functions demand the location of the officers concerned in each Province and prolonged work in one part of India. The application of the results of research does not involve such a high standard of technical training and with the separation of the executive functions from the research work the former should remain with the Local Government. As to financing research an increase in the efficiency of production will enable an increase in the general revenue to be made but in the first instance there must be found means of increasing the efficiency. As an example of one method of obtaining finance the following may be given.

An export cess on hides and skins may be taken as a source of finance for veterinary research with a view to improvement of cattle, this research being done under the Government of India. Application of the results of this research and supervision of flaying and propaganda throughout the Province with regard to flaying and curing of hides, being executive functions should be placed under Local Governments. The application of cesses for the general purpose of finding finance for agricultural and veterinary developments might with advantage be extended.

The following are some of the more important cesses in existence:—

- (1) Tea cess (Indian Tea Cess Act, IX of 1903.) A cess of six annas per 100 lbs. is levied on all tea produced in India and exported from British India. The cess is collected by Government and paid to the Tea Cess Committee after deduction of expenses for collection.
- (2) Jute cess. (Bengal Act V of 1911.) A custom duty is levied on raw jute other than cuttings and rejections at the rate of two annas per bale of 400 lbs. and twelve annas per ton of 2,240 lbs. of manufactured jute. The duty is collected by Government and paid to the Calcutta Improvement Trust.
- (3) Lac cess. (Indian Lac Cess Act, 1921.) A cess is levied on lac and refuse lac produced in India and exported from British India, the rate being four annas per maund for lac and two annas per maund for refuse lac. The cess is collected by Government and paid to the Indian Lac Association for research after deduction of expenses for collection.
- (4) Cotton cess. (Indian Cotton Cess Act, XIV of 1923). A cess of two annas per standard bale of 400 lbs. and six pies per 100 lbs. for unbaled cotton are levied on all cotton produced in India and either exported from British India or used in any mill in British India. The cess is collected by Government and paid to the Indian Central Cotton Committee.

The work of the Tea Cess Committee, financed by a cess on tea, has been successful, tea production being highly organised and under more or less

immediate control, that is, the crop at any time can be modified by the joint action of the organised growers. Part of the jute cess is used for purposes other than the development of agricultural efficiency, *e.g.*, a portion of it goes to the revenue of the Calcutta Improvement Trust. The lac cess is devoted to research work in connection with lac, but in this case the industry is by no means highly organised. The work of the Indian Central Cotton Committee is financed from a cess on cotton, and it performs functions of a highly beneficent nature to the cotton producers. Wherever possible, revenue derived from agricultural produce might reasonably be allotted, at least in part, to financing agricultural research and demonstration.

QUESTION 4.—ADMINISTRATION (c) (iii)—*Roads*.—India like some other Asiatic countries may be divided into two parts, Interior India and Exterior India, Exterior India being that portion of the country which is served by railways, Interior India being those parts remote from any railway line. It seems fairly well established that railway transportation is much more efficient and cheaper than road transportation, but extension of roads feeding the railway lines would presumably enable the cultivator at some distance from the railway to obtain higher prices for his produce and enable him to adopt methods which would tend to increase the production from his land. The extension and improvement of roads from railway stations into the interior will probably result in the introduction of a more efficient method of transportation of agricultural produce than at present exists.

QUESTION 10.—FERTILISERS.—In the case of tea, the Indian Tea Cess Association popularised the use of tea in India by providing it for consumption throughout the country at a cost which was frequently below production. A similar method might be utilised for the popularisation of new and improved fertilisers, the Agricultural Department of the Local Government being used as the agency for the distribution at cost price or even at a price slightly below cost. This, of course, involves a financial responsibility which might be met from funds obtained in a manner somewhat similar to that in which the activities of the Indian Tea Cess Association are financed.

QUESTION 14.—IMPLEMENTS.—One of the difficulties which manufacturers have to contend with at present in their efforts to sell agricultural implements throughout the country is the scattered demand for such implements. The number of orders forthcoming is not sufficiently large to justify manufacturers in entertaining a staff in the mofussil. The sale of agricultural implements therefore on a hire purchase system direct by manufacturers has not met with much success. This is a direction in which it should be possible for Local Governments to come to the assistance of both the cultivator and the manufacturer. If an arrangement could be arrived at between the Government and the manufacturer whereby Government would be responsible for the collection of instalments by means of its organisation it seems probable that the sale of agricultural implements would extend in India. State aid to the cultivator in the form of hire purchase legislation for the purchase of machinery or even of fertilisers seems feasible.

QUESTION 26.—STATISTICS.—A note has already been submitted to the Commission on questions of Agricultural Statistics in India. I have only one suggestion to make under this head and that relates to the revival of the Rail-borne Trade Statistics. The Board of Agriculture in 1924 recommended—"That the compilation of rail-borne trade statistics should be revived, as these statistics provide for many crops a most important check on the estimates of production." Forecasts of production now depend on three factors: area, condition factor and standard yield. Changes in the standard yield can only be made as a result of crop cutting experiments, but the condition factor can be corrected in the light of trade statistics. The necessity for these figures of rail-borne trade is all the greater with regard to Indian States where forecasting is much less accurate than in British Provinces. Besides acting as a corrective to crop forecasts these statistics will be an index to agricultural prosperity to some extent.

Oral Evidence.

A.3016. *Sir Henry Lawrence*: Dr. Meek, you are the Director General of Commercial Intelligence. Are you also in charge of statistics?—Yes.

A.3017. How long have you held your present office, and what was your official experience in India prior to occupying it?—I came to India in February 1911 as Professor of Physics, Dacca University; I was in the Indian Educational Service. I became Director of Industries in 1920 and in April 1926 I became Director General of Commercial Intelligence.

A.3018. What is the principal point which you wish to bring to the attention of the Commission? Is there any considerable improvement in statistics that you have been advocating?—No, there is no particular point as far as agricultural statistics are concerned. I have submitted a note* to Dr. Clouston for the Commission on the history and preparation of agricultural statistics.

A.3019. Then you are satisfied with the condition of the agricultural statistics as they stand now?—In that note, copies of which I see members have before them, I have indicated one or two points where in my opinion improvement might be made.

A.3020. Would you indicate them, very briefly?—These agricultural statistics depend, as far as forecasting is concerned, on three factors: the acreage, the standard yield and the condition of the crop. The acreage factor is fairly accurate; the standard yield is one of the factors which could probably be improved. The condition of the crop is not so accurate, perhaps, as the standard yield. These two factors, the standard yield and the condition of the crop, are the two factors which could yield better results if they were improved.

A.3021. Is the acreage accurate in a Province such as Bengal?—I have explained in my note that it is more or less an estimate, but it is improving. Where you have permanent settlement, the acreage figure is not so accurate as it is in some of the other Provinces.

A.3022. Have you a reporting agency over the greater part of the Indian States? Do the statistics of acreage include the Indian States?—Not all the Indian States; but most Indian States report to us statistics of acreage.

A.3023. What proportion of them report to you satisfactory figures?—About 56 per cent. of the total area of Indian States are reported on in agricultural statistics.

A.3024. If you wish to know the total yield of cotton, of which a fair proportion is grown in the Indian States, can you get (within a reasonable margin of error) what the total yield will be?—Yes, cotton statistics are fairly accurate. We have a check on them from the figures of baling we get and from export figures and consumption figures.

A.3025. Through what agency do the baling presses report?—Through provincial officers such as Directors of Agriculture, Directors of Industries, Chief Inspectors of Factories, etc.

A.3026. Every ginning press?—Yes, through above-mentioned officers.

A.3027. In Indian States as well as British India?—No, not in all Indian States. Five Indian States are furnishing press returns.

A.3028. In British India is that duty imposed upon them?—Yes, by the Act of 1925.

A.3029. Is there any particular action you wish the Government of India to take for the improvement of the statistics in connection with any of the three points you mention?—I do not wish to put forward any proposals at present. Nos. 2 and 3 will improve as time goes on.

A.3030. The condition of the crop in a particular area is reported by *Pattawaris* and officers of that character. Is there a general tendency on their part to over-estimate or under-estimate?—We have a feeling that there is a general tendency towards under-estimation. I have stated that in my note. The general estimate seems to be always rather pessimistic, and instead of

* *Vide* Pages 353-364.

taking a percentage of what we call the normal crop, we feel they take a percentage of what they would like the crop to be.

A.3031. A percentage of the optimum rather than the normal?—Yes.

A.3032. Do you deal with forecasts?—We publish forecasts.

A.3033. Do you correct the estimates that come to you by any formula?—No, we simply publish the material which is supplied to us.

A.3034. By the Director of Agriculture?—Yes and other officers. We simply compile the figures and publish them. We publish provincial forecasts as well as forecasts for the whole of India.

A.3035. Do you rely on the Director of Agriculture to level up these original estimates which you regard as too low?—Yes.

A.3036. Does that process go on in the office of the Director of Agriculture?—Yes.

A.3037. When they reach you, do you think they are fairly accurate?—Yes, fairly accurate.

A.3038. Not markedly too low or too high?—Considering the agency by which the original material is obtained, I think they are fairly accurate. If we think an estimate appears to be far out we draw the attention of the Director of Agriculture to it.

A.3039. Are there any complaints made by any trades asking for improvement in these forecasts? There used to be some years ago?—There is frequently a complaint regarding the jute forecast.

A.3040. Do they think jute forecasts too optimistic or pessimistic?—Sometimes one way and sometimes the other. It is a forecast got out by the Director of Agriculture in Bengal direct. I do not know of any trade complaints regarding other forecasts.

A.3041. *Professor Gangulee*: The other forecasts are not made by the Department of Agriculture; only the jute forecast is made in that way?—That is so. The figures for other crops are supplied to us by the Provincial Departments and we compile them for all India.

A.3042. *Sir Henry Lawrence*: In every case the information comes from the Director of Agriculture, does it not?—In the case of tea, coffee and rubber it comes direct from the gardens. The figures for all the major crops we get from the Agricultural Departments.

A.3043. *Sir James MacKenna*: Except rice in Burma, which you get from the Commissioner of Settlements?—Yes.

A.3044. *Sir Henry Lawrence*: What are your relations with the Indian Trade Commissioner in London? Have you any particular liaison with that officer?—We try to put people in India in touch with purchasers in other countries, and if these countries happen to be in Europe, we generally do it through the Indian Trade Commissioner in London, because he has more extensive information regarding the standing of firms in Europe than we have. In other parts of the world we work through the Department of Overseas Trade representatives; in Canada and South Africa, for instance.

A.3045. You are in communication with officers belonging to the Department of Overseas Trade?—Yes, in all countries where there are such officers. When there is a reference to any European country, however, we generally work through the Indian Trade Commissioner.

A.3046. Has the Indian Trade Commissioner got his office along with the High Commissioner?—He has his office in the High Commissioner's office in Grosvenor Gardens. He had at one time an office in the City, but that was given up owing to retrenchment. He now has a room in the City to which he goes two or three times a week to interview business men.

A.3047. In your opinion is the present situation of his office near Victoria Station, a convenient one for the promotion of trade in London?—The situation of his office may be bad, but the system of having an Indian Trade Commissioner in London is good.

A.3048. Do you think he is sufficiently in touch with the City?—I think, as a matter of fact, the Indian Trade Commissioner at present is in very close touch with the City. There is now a proposal to have another office in a more convenient spot. That proposal is before the Government of India, and I think it has been accepted at any rate by the Standing Finance Committee.

A.3049. The expenditure will be on this budget?—I believe so.

A.3050. *Sir James MacKenna*: With 8 lakhs as a first contribution?—Yes. That will certainly bring his office into closer touch with the people in the City, but at present he is personally in very close touch (and has been for a long time) not only with business people in London but in Manchester and other parts of the United Kingdom.

A.3051. *Sir Henry Lawrence*: Does that officer concern himself with the questions affecting the purity or grading of exports from India?—He writes frequently about these questions and we try to get the people out here to do something, but actually he cannot do very much if the trade does not move in the matter.

A.3052. Have you heard complaints of the impurities in wheat and oil-seeds?—Yes, both in wheat and oil-seeds we have had complaints; the Indian Trade Commissioner writes out here, tells us what the complaint is. We go to the exporters; they generally know a fair amount about the complaint before we hear about it; we ask them what they can do and that is about where it ends.

A.3053. You ask them to do something about it?—Yes, ask them if they could improve the quality.

A.3054. Is there any action that they wish Government to take that is feasible? Have the exporters from India made any suggestions to you that Government should take action?—No, they have never put forward any suggestions so far as I know; I understand there is a clause in the wheat contract which limits the percentage of dirt to a certain figure; I do not know whether that is still in force or not.

A.3055. Do these questions of grading come strictly within the functions of your office?—No, it does not really come within our duties, but if we feel we can do anything, we make an effort unofficially; we simply try to do the best we can by visiting the exporter and explaining to him what the complaint is.

A.3056. Have you any suggestion to make as to any action that could be taken by Government to meet these complaints?—I have not actually thought of any action, but you must be aware of the fact that Government has established a Grading Board for the export of coal; it might be possible to establish a Grading Board for the export of other materials as well as coal. The Grading Board for coal gives a certificate of the quality of the coal exported.

A.3057. Is there any such machinery in being in any other country that you know of?—I believe there is some such machinery in Canada with regard to the export of wheat, but I do not know any of the details; that is with regard to the pooling of wheat.

A.3058. That is connected with the elevator system, is it?—Yes, but I do not know the details.

A.3059. A specific case with regard to ground-nuts was mentioned to this Commission recently in regard to the method of decortication, the ground-nuts being wetted. Have you had occasion to enquire into that at all?—I have not had any occasion to enquire into it, but I think I know about it; I think they wet the ground-nuts when they are decorticating them, and they are rather inclined to ferment. It has not been brought to our notice.

A.3060. Who should move in such a matter? Should the initial impetus come from the Chambers of Commerce?—In all these cases we like the impetus to come from the trade itself, because if a Government officer interferes in any way, it does not help much; if the impetus were to come from the trade probably something could be done.

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A.3061. But so far no Chamber has moved in this matter?—In that particular matter I should not think so.

A.3062. If they did move, in what form or shape would it be? By representation to the Department of Commerce and Industry? Would that come to you in the ordinary course?—It would probably come to the Government of India first of all and then be sent to me to enquire into it and report.

A.3063. So far that has not been done?—No.

A.3064. Then, with regard to the general aspect of your work of commercial intelligence, is there any particular action or policy that you wish to suggest that requires further investigation?—I have made suggestions to other Commissions and Committees; for instance, to the Textile Committee I suggested that it would be advisable to have representatives in, say, South Africa, East Africa and Mesopotamia with a view to extending export trade with those countries, but I have not put forward that proposal to this Commission.

A.3065. Do you regard that as a matter of some importance?—Yes, to have overseas representatives, in fact, Indian Trade Commissioners, in other countries besides the United Kingdom. It is not a new proposal, it has been before the Government of India before; it was discussed in 1919 and 1922 and the department had a representative in East Africa for about a year, an Indian Trade Commissioner, with a view to finding markets for Indian exports overseas.

A.3066. Have you got any Indian officers of good status who are being trained in this work of commercial intelligence in your office?—We have only one Indian officer and he is fairly advanced in years now; we have no others coming on being trained.

A.3067. If you had such Indian Trade Commissioners in those countries would you be able to find suitable officers to fill the posts?—I think it would be possible to find suitable officers.

A.3068. Indians?—I think they would almost certainly be Indians.

A.3069. Would they not require any special training?—They would probably have to spend some time in the department before going overseas.

A.3070. At present there is no machinery for that?—We have no machinery at present for training them as so far there have been none.

A.3071. *Sir James MacKenna*: On page 365 of your note you refer to an export cess on hides and skins. I take it that so far from desiring its abolition, you suggest that it might be increased?—At present there is an export duty of 5 per cent on hides and skins; there is a feeling that that export duty might be removed sometime in the future.

A.3072. I suppose you are aware that there is a very strong feeling against it, except in Madras and Cawnpore?—There is a very strong feeling against the export cess, and I believe the general idea is that it will be removed. This proposed cess is supposed to be a relief, a very small thing; if the 5 per cent was removed this might be only a half or a quarter per cent; it would be a nominal export cess after the 5 per cent has been removed.

A.3073. What did Burma say about that?—I have not been to Burma yet; I have not discussed it with them. I discussed it with the Calcutta Hides and Skins Shippers' Association last Friday. This cess would not bring in very much revenue. I have not worked it out, but could easily do so.

A.3074. Even under the existing 5 per cent I do not think the revenue is a great sum; it causes a great deal more irritation than financial result?—If we got the total figures of export of hides and skins, we could easily work out how much revenue it would yield.

A.3075. Are you generally in favour of export cesses?—No, generally I am opposed to export cesses.

A.3076. Do you think export cesses would be more justifiable if a portion of the resulting revenue were to go to specific researches on particular crops?—Yes, I think that is the only way in which these export duties can be justified; that is to say, that the revenue returns are to be spent on the actual

trade as is done with regard to tea, lac and cotton. The jute cess is not used in that way.

A.3077. Do you consider the Agricultural Department is the suitable agency for framing crop forecasts, or can you suggest any other department of Government that has better material available for the purpose?—I cannot think of any other department that would have any better material than the Agricultural Department; the difficulty with regard to these forecasts is that the material is perhaps not as good as it might be.

A.3078. The point is that the Agricultural Department has not any particular interest in the area, which is of equal, if not greater, importance than the outturn?—Of the three factors area is the big one and area seems to be fairly accurate.

A.3079. That is from the land record side?—Yes. Then there are these two other factors: the standard yield and the condition. The condition is generally expressed in so many annas: a sixteenth; if it is wrong by one anna you have $6\frac{1}{4}$ per cent error straightway; whereas the area is not likely to be wrong to the same extent.

A.3080. So that for determining the outturn, which is of course a basic factor, you think the Agricultural Department is in the best position?—I think so.

A.3081. Have you had any representations from the Agricultural Department about the excess of work which it throws on their staff or the inadequacy of their staff for the purpose?—No, I have not had any representation.

A.3082. Are you in favour of a separate statistical branch in each Province to deal with crop forecasts and other statistics?—A branch of the Agricultural Department?

A.3083. Yes, giving them more staff?—Yes, certainly I am in favour of giving them more assistance if they need it.

A.3084. I think you are an *ex-officio* member of the Central Cotton Committee?—Yes.

A.3085. What is your view of the work of that body?—I have been in that position only for the past 10 months and have had the opportunity of attending only one of the meetings.

A.3086. How does it strike you? Does it strike you as being a body getting down to the problems of cotton research and development?—I do not know that I could express an opinion that would be of much value having attended only one meeting.

A.3087. Have you any indication in your office that they are taking any keen interest on the statistical side of the work?—Yes.

A.3088. You have regular returns of the amount of cotton pressed issued by your office?—Yes; we issue them weekly.

A.3089. Is that of any assistance to the trade?—The trade is very anxious to have it; so far as I can judge it has been of great assistance to them.

A.3090. Do the Indian States take any interest in them?—Yes, to a certain extent, but not to the extent that we should like.

A.3091. Are the main cotton growing States coming in?—Yes, they are gradually coming in.

A.3092. There is the Cotton Ginning and Pressing Factories Act. Do you think that it is of any material assistance to the cotton industry?—The manufacturers are very keen about those statistics; they are anxious to have them as rapidly as possible, so they must be of assistance.

A.3093. Are these returns the result of the operations of the Indian Cotton Committee of 1917?—I should think so, but I have not studied the point.

A.3094. *Professor Gangulee*: With regard to the research work which you have mentioned, would you have the Government of India set up an agency for co-ordinating the activities of the provincial research organisations, or would you have them carry out research in their own organisation?—I would

place the research work under the Government of India and the organisation would be the Government of India organisation.

A.3095. The research should be done entirely by the Government of India and their staff?—Yes in different localities. For instance the research work referring to jute you would have in Eastern Bengal, but it would be under the Government of India and not the Local Government.

A.3096. Research work in cotton to be in cotton areas, research work in rice to be in Madras or Burma and so on; is that your idea?—Yes.

A.3097. You would not entrust the Provincial Government with any research work at all?—I think it would be more economical to keep the research work under one body, the Government of India. We started a little research in tannery in Calcutta and it is believed to have done good work. Then the other people throughout India all began to think that research is a good idea and the tendency is to start research tanneries all over the place, whereas one research tannery running well and doing good work can produce good results for wide areas.

A.3098. Your idea is that the fundamental researches should be carried out by the Central Government and they would transmit any information they get to the Provincial Departments and the Provincial Departments would test the results in their experimental farms?—Yes. The Government of India could certainly depute the officer who had done the research work and had arrived at his conclusions to instruct the Local Government officers.

A.3099. So you would have the Provincial Departments of Agriculture simply to do demonstration?—Demonstration and propaganda.

A.3100. No experiments?—The experiments would be done by the Government of India in the local areas.

A.3101. *Sir Henry Lawrence*: Do you anticipate any friction between the Imperial and the Provincial Governments in regard to the distribution of functions and things like that?—I do not think the idea would be popular with the Local Governments, the idea of separating the functions; but I suggest this as a method of co-ordinating the work and to save overlapping and from the point of view of economy and also to give men who are doing research work freedom and liberty to go on with research work without having their time occupied in demonstration and propaganda work.

A.3102. *Professor Gangulee*: I find from your note that the tea cess is utilised for research work in connection with tea and the same is the case in regard to lac and cotton; but in regard to the jute cess the amount collected is given to the Calcutta Improvement Trust and nothing is spent on jute experiments and jute research?—I do not think the whole of it is paid to the Calcutta Improvement Trust.

A.3103. A portion of it goes to the Government of India?—I have not got the Act with me, but I think 2 annas in the rupee, or something like that, goes to the Improvement Trust.

A.3104. A portion of it goes to the Improvement Trust and another portion to the Central Government, and none for research in jute?—Except that the portion going to the Central Government goes to the general revenues.

A.3105. But it is not earmarked for jute research?—No.

A.3106. Do you think that the earmarking of particular revenue for a particular purpose is a sound financial policy?—I think it has been fairly successful in certain directions. The Indian Tea Cess Act has been fairly successful. There of course you have very highly organised industry, capable more or less of control.

A.3107. You make a reference to roads. Are you aware of this idea of a Central Road Board?—Yes.

A.3108. What is your view on that?—I have simply indicated that I think if it were possible to have local roads running out from different railway lines as feeders to the railways it might be more economical so far as transport is concerned.

A.3109. What would be the relation of the Central Board to the Provincial Road Board?—I have not thought it out at all.

Dr. D. B. Meek.

A.3110. With regard to fertilisers and other things you say that Agricultural Departments of the Local Governments should be used as agents for distribution. Would you not like to have business men or private enterprise undertaking that?—First of all to make the fertilisers popular I would introduce them through the Agricultural Departments. As I have said I would, even go so far as to distribute free samples of fertilisers.

A.3111. *Sir Henry Lawrence*: At the expense of public revenues?—Yes.

A.3112. *Professor Gangulee*: You would have the Government to distribute the fertilisers and you suggest that implements also should be given on the hire purchase system by the Government to the cultivators; you eliminate private enterprise altogether from this sort of work?—Private enterprise at present cannot do it because the whole thing is so scattered.

A.3113. In introducing artificial fertilisers do you not think that Messrs. Shaw Wallace & Co. did more than the Departments of Agriculture? This year the British Sulphate of Ammonia Federation in London have earmarked £20,000 for propaganda work in India. Do you not think it advisable for the Provincial Departments of Agriculture to co-operate with the trading agencies?—I think I have indicated that this business of giving out samples is merely to popularise it and more or less as propaganda work. I do not want to turn the Agricultural Department into companies for selling fertilisers.

A.3114. Turning to the question of statistics, what is the basis of calculating standard outturn per acre?—It is done by the Agricultural Department.

A.3115. Through their crop cutting experiments?—Yes.

A.3116. Would you tell us how these experiments are conducted and by whom?—I do not know.

A.3117. Are they conducted on any one definite area or at random?—I do not know.

A.3118. What is the system adopted in the Punjab for the purpose of crop cutting experiments?—I do not know.

A.3119. Have you considered the possibility of aeroplane photography for reporting crop condition?—No, I have not thought of it.

A.3120. That is being tried in America and also in England?—I have not thought about it.

A.3121. You have, in the ryotwari tracts, your subordinate revenue agency and you find it convenient to collect agricultural statistics in those areas, but you find it difficult to get them in permanently settled areas?—Yes.

A.3122. Have you got any suggestions to make as to how that difficulty could be overcome?—No, I have no suggestions to make.

A.3123. I find that in your 'Agricultural Statistics' you do not give the value of produce; you give only the total amount of it. Do you think it is advisable to give the value of production based on the harvest prices?—I suppose it could be done as harvest prices are given.

A.3124. My general impression is that there is no uniformity in the method of collecting the statistics throughout India; they vary from Province to Province, do they not?—Yes, in details but uniformity exists in the general principles.

A.3125. Do you think some sort of uniformity would be advisable, some standard method?—Of course I would mean increase in staff in department which collect the materials.

A.3126. *Mr. Calvert*: What is the present position in regard to the revival of the rail-borne statistics?—The file came to me only the other day and I am taking up the question. May I say that we started collecting certain figures for cotton and we are getting returns from Railways with regard to the movements of cotton from one block to another. That is the first step and it is costing us about Rs. 10,000 a year. The revival of rail-borne statistics is a matter of money and Local Governments have stopped collecting those statistics and they will not probably be very willing to start them again. The subject however is before the Government of India and the idea is to revive them.

Dr. D. B. Meek.

A.3127. Are there any Local Governments who have already agreed to revive them?—The Central Provinces Government has continued collecting them all along; I do not know about the other Governments having agreed.

A.3128. Do you think there is really much advantage in collecting totals for all India? Are not the totals of different things misleading? Take the case of bulls: sometimes you would show about one bull to 500 cows; and in the next quinquennial return you would show perhaps one bull to 50 cows. The meaning of the word bull would vary enormously according to your statistics?—These are figures which are collected by Local Governments and sent to us and we put them together; that is all we do really.

A.3129. Do you think that the totals are worth publishing? The totals of two quite different things would be misleading; for instance, a pair of bullocks in the Punjab can plough 14 acres; in Bengal we were told they can plough only about 3 acres?—It is really the total of the animals and not the total of the motive power that is shown.

A.3130. Do you think your estimates of yields are of any value?—I suppose they have some value.

A.3131. The ordinary commercial people in the Punjab add 30 per cent of the official estimate. Is that the correct thing to do?—That is their method and if by adding 30 per cent they are sure of obtaining the correct figures the statistics surely have some value.

A.3132. Did you ever hear of a challenge given to expert agriculturists that not one of them could estimate a crop within 25 per cent?—No.

A.3133. Can you suggest any way of avoiding the human element in these outturn estimates?—The only thing I would suggest would be to go on with the crop cutting experiments.

A.3134. But, as long as your cutter selects the field, he takes what he thinks is the average or the normal and then he says that that is the average or normal; that is to say he first gets the answer and then produces the method of arriving at it? Is there any method in other countries where the human element is eliminated?—If we could get the final figures of the actual production we might be able to do something.

A.3135. But that is not possible?—No.

A.3136. In the United Provinces land is about half the value of what it is in the Punjab but their estimated outturns are 50 per cent higher than ours. That suggests that the outturn figures are worthless. Have you ever enquired into that at all?—No, but we know that that is the factor in the statistics which is least satisfactory.

A.3137. *Mr. Kamat*: In this estimate of outturns you take your figures from the Agricultural Departments and they in their turn depend on the revenue agency. Is it possible to make the Agricultural Departments self-sufficient in this respect, without depending on the Revenue Departments?—If you make them self-sufficient you simply increase the number of the staff required, and incidentally the expenditure would also increase.

A.3138. I am told that in the Madras Presidency there is a statistical branch under the Department of Agriculture who do the statistical work; is that true?—I cannot say.

A.3139. You say on the question of staff that it would entail a very heavy expenditure if to the Agricultural Department is attached a statistical department of its own?—If they are going to collect original materials then it will mean a large expenditure, but if they are simply going to put together in the head office the materials which they get from other sources, then it would not mean a very large expenditure. But if you are going to change the staff that collects the materials, then you are going to duplicate it practically.

A.3140. With regard to this question of a cess on exports, when you collect the cess, for instance, on tea, jute or cotton, and when you hand over, after deducting the expenditure, the amount collected to the different committees such as the Cotton or Tea Committees, do you impose any conditions on them? Have they to submit to you the annual accounts showing how they spend the money?—I think that the accounts have to be published and audited in the usual way as far as I remember.

A.3141. Is there any control which accompanies the payment of these collections to these different committees?—Not that I know of. In the case of the Indian Association Committee I do not think there is any control; I think the money is handed over to them to use it to the best advantage.

A.3142. They have the fullest discretion to use the money to the best advantage?—Yes.

A.3143. You said you were against the idea generally of an export cess. Is your objection simply because of this *ad hoc* taxation principle, or earmarking principle?—No, I said I was against the principle of the export duties.

A.3144. If that money could be used for the development of agriculture, would you still be against it?—Not if it goes back into the industry from which it was taken.

A.3145. Would you not be none the less against the thing on principle?—No.

A.3146. And you would also not impose any control on the part of the Government of India if the money were to be utilised by the Local Governments at their best discretion for agriculture?—I suggested that they should use it for research in agriculture and I also suggested elsewhere that the research should be under the Government of India.

A.3147. You said in the case of tea or cotton organisations there was no control, to your knowledge?—Not so far as I know.

A.3148. Would you extend the same principle if a fund collected, say, for agricultural purposes were handed over to Local Governments without control?—If there was a chance of its being utilised as successfully as in the case of the tea cess, then I think I would agree.

A.3149. If the Government of India do not insist on control in the one case, surely they can carry out the same principle in the other case?—The Indian tea industry is very highly organised and highly controlled.

A.3150. But if you can trust the Indian tea organisation, I think surely you can equally well trust the Local Governments?—Yes.

A.3151. *Sir Thomas Middleton*: You pointed to the case of your tannery in Calcutta as an illustration of the benefit of centralised research. Does it not occur to you that much of the work with which Agricultural Departments are concerned is so conditioned by local factors that a centralised institution might not in their case be as suitable as in the case of your tannery?—I think I tried to indicate to Professor Gangulee that the research work would be done under local conditions although it might be directly under the control of the Government of India.

A.3152. That would take the responsibility for research entirely out of the hands of the Provincial Departments of Agriculture?—Yes.

A.3153. You have already indicated that you are aware of the very strong feeling which would be created if any such attempt were made?—Yes, I think so; but at the same time I still think that greater progress will be made in research if the energies of the men who are doing research work are co-ordinated. The difficulty about research work in this country is the lack of atmosphere.

A.3154. And the lack of men?—The lack of men first of all, and also the lack of a scientific atmosphere. It is very difficult for a man in the Province to carry on research work simultaneously with his ordinary office work. There cannot be any continuity when he has to look after both jobs. I think myself that more progress would be made if the men who are doing research work could be kept on that work for a longer period of time and could be given facilities for meeting other men who are doing research work in order to discuss and exchange views on their problems and their difficulties.

A.3155. While the work of a Director of Agriculture is mainly administrative, he is a man who has presumably lived in the Province for, let us say, 20 years and during this long period he has been up against the difficulties which crop up in a Province. Do you not think that his views in connection with what is required to be done would be most valuable in formulating the lines of research?—These lines of research could probably be laid down by

some central body such as you have in existence at present in the shape of periodic conferences which should meet at short intervals. At present these conferences take place at intervals of about two years, and I would suggest that they should meet at shorter intervals.

A.3156. You referred to the possibility of distributing free samples of fertilisers. I think your idea was that these free samples should take the form of small quantities to show how they were to be used in field work?—The fields in which definite types of fertilisers had been used should be indicated.

A.3157. And the work would be definitely experimental in character?—Yes.

A.3158. And the total quantity required for the Province would be quite small?—I had no intention of distributing fertilisers free to the whole Province; it would be quite a small thing.

A.3159. You are possibly aware of the fact that the practice is commonly followed in Great Britain?—Yes.

A.3160. Your own functions with regard to statistics are purely editorial?—Yes, practically compiling and publishing these agricultural statistics. But we examine and scrutinise the statistics before compilation and point out to local authorities any errors or discrepancies that may be found out, for explanation or correction.

A.3161. Reference has already been made to the errors which occur and the difficulties which arise in certain Provinces. Have you at stated intervals conferences of all those concerned in supplying you with agricultural statistics?—Yes, there have been such conferences in the past. I took over this work only ten months ago, and I have not attended any such conferences, but I know from the records they have been held in the past.

A.3162. The difficulties and errors which may occur in connection with statistics in certain Provinces have presumably been discussed at these conferences?—I expect so.

A.3163. You say that generally speaking you are satisfied with the area figures?—Yes.

A.3164. I have heard it said that there is considerable doubt as to whether the figures of the professional surveys are accurate. They correspond very closely with the figures taken from village papers; indeed, for All-India the correspondence is suspiciously close. Do you think there are compensating errors in both which may account for the correspondence?—Possibly.

A.3165. You have indicated that in one Province in particular the figures were doubtful. Are there not others where they are almost equally so? In the case of which Provinces do you think the figures are based largely on estimates?—Bengal, Bihar and Orissa, parts of Madras and Assam.

A.3166. The others are reasonably accurate?—Yes.

Except that Mr. Calvert has told us that in the Punjab the official estimates of outturn must be a long way out.

Mr. Calvert: They are everywhere.

A.3167. *Sir Thomas Middleton:* You have told us you are not aware of the number of crop experiments now being made?—No. (See provincial reports of crop cutting experiments.)

A.3168. These crop experiments have in certain Provinces been conducted very extensively and for a long time. Do you know whether there is any sort of uniformity amongst Provinces as to the number of crop experiments?—I have no figures on which to base an answer to that question (there appears to be no uniformity).

A.3169. Would it not be desirable to arrange some uniformity of system in crop experiments?—Yes.

A.3170. *Sir Henry Lawrence:* You have referred to export cesses in your note. In addition to these there are export duties, for instance on jute. Do you consider there is a case for demanding the expenditure of a portion of the money so obtained in research which will benefit the particular crop on which a duty is levied?—That would mean earmarking portions of duties. At pre-

sent they go to general revenues and research work is financed from general revenues.

A.3171. On what items are there export duties?—Jute, rice, hides and skins and tea.

A.3172. Is there a duty as well as a cess on tea?—Yes.

A.3173. It has been represented with regard to certain industries that since they are paying specifically to Imperial revenues something ought to be done for them from those revenues in the way of research. Do you think that is sound?—Yes.

A.3174. Can you give us any general figures showing the percentage of export trade to internal outturn?—I have not worked out any figure for that, but I believe a figure of 10 to 1 was worked out at one time, i.e., 10 times as much was consumed in the country as exported. I will try to work out as accurate a figure as possible and let you have it.*

A.3175. It has been suggested to us, with regard to the staff engaged in research at Pusa, that it would be better if that staff were interchangeable with the Provinces. I take it you are opposed to that view?—I should be in favour of allowing these men to be deputed to the Provinces. I think the idea was that they should be brought in touch with day-to-day problems of administration and not confined solely to research.

A.3176. You would prefer them to be engaged solely on research from start to finish?—Yes, but I should expect them to keep in touch with the problems on which they were doing research.

A.3177. Mr. Calvert: Did you see the report of the committee appointed by the Punjab Government under my chairmanship to inquire into methods for improving agricultural statistics?—No.

A.3178. You were not consulted about that?—No.

A.3179. Professor Gangulee: Do you think trading circles in Great Britain interested in agricultural produce get adequate information from your department?—We send a weekly cable to the Indian Trade Commissioner, and he publishes it or rather we send it to Reuters, who publish it. It is also published in the Board of Trade Journal. The cable is a summary of information supplied to us regarding weather and crop conditions.

A.3180. You think you are giving enough publicity to Indian agricultural produce in England?—If we are asked for more information we give it. When there are any questions they come to the Indian Trade Commissioner in London, and he seems to be satisfied with what we send.

A.3181. Sir Thomas Middleton: Do you call the 16-anna crop the normal or the optimum crop?—We take 100 as the normal.

A.3182. What is 100 converted into annas?—We still get figures from the Provinces in annas, and we have for each Province what we consider to be their normal, which may be 12 annas for one Province, 10 for another and so on.

A.3183. Could you let us have a list of the normals for the different Provinces?—I shall send that to you.†

(The witness withdrew.)

For the evidence of other witnesses examined at Delhi, see the Volumes of Evidence for the United Provinces and the Punjab.

* Reference may be made to Table No. 44 of the *Review of Trade* for 1925-26, showing the proportion of exports to total outturn in the case of certain principal crops for which complete figures of production are available. It would not be unreasonable to estimate that in normal years about 10 per cent of the total outturn of food grains is exported from India. Regarding oil-seeds, the exports in an average year may be put at about one-third of the total production. In the case of cotton and jute the internal consumption is much below the production and about 50 per cent of the total output is normally exported. Tea and coffee are principally grown for export abroad.

* *Vide* Appendix.

APPENDIX.

Statement showing the number of annas by which a normal crop is indicated in the various Provinces.

Madras	}	12 annas.
Bombay		
Bengal		
Assam		
Bihar and Orissa		12 to 14 annas.*
Central Provinces and Berar		13·3 annas.
†Burma	}	16 annas.
United Provinces		
Punjab		
N. W. F. Province		
Delhi		
Ajmer-Merwara		
Coorg		

* 12 annas in twelve districts, 13 annas in seven districts and 14 annas in two districts.

† Anna notation no longer used, American notation being used.

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GLOSSARY.

ANNA	One-sixteenth of a rupee; equivalent to 1½d. at exchange rate of one and sixpence to the rupee.
ARHAR ...	...	Pigeon pea (<i>cajanus indicus</i>).
ATTA ...	...	Wheat flour.
BABUL ...	...	A widely distributed small tree (<i>acacia arabica</i>).
BAJRA ...	...	A small millet (<i>pennisetum typhoideum</i>).
BANIA ...	...	A Hindu trader who is generally also a moneylender.
BARANI ...	...	Unirrigated land depending on rain for its water supply
BERIBERI ...	...	A dangerous deficiency disease endemic in parts of India and Ceylon.
BERSEEM ...	...	Egyptian clover (<i>trifolium alexandrinum</i>).
CASTOR... ..	...	<i>Ricinus communis</i> .
CHAPATTI ...	...	A thin unleavened cake of flour and water, slightly baked over an open fire.
CHOLAM ...	...	The Tamil name for the large millet (<i>sorghum vulgare</i>).
CHULHA ...	...	A fireplace.
CRORE ...	...	Ten millions.
CUMBU... ..	...	See <i>Kambu</i> .
DAL ...	...	A generic term applied to various pulses.
DESHI ...	...	Native to the country, indigenous.
DHUB ...	...	Couch grass (<i>cynodon dactylon</i>).
GHAT ...	...	A mountain; a landing place on the bank of a river.
GHI ...	...	Clarified butter.
GOGU ...	...	A fibre plant (<i>hibiscus cannabinus</i>).
GOLA ...	...	A storeroom.
GRAM ...	...	Chick-pea (<i>cicer arietinum</i>).
GUINEA GRASS	...	<i>Panicum jumentorum</i> .
GUR ...	...	Unrefined Indian sugar, jaggery.
JAMADAR (JEMADAR)...	...	A supervisor.
JUAR (JOWAR)...	...	The large millet (<i>sorghum vulgare</i>).
JUNGLI...	...	Wild, waste, savage; belonging to the forest.
KALA-AZAR ...	...	A chronic fever of North East India with greatly enlarged spleen; resistant to quinine.
KALAR ...	...	Saline efflorescence.
KAMBU... ..	...	A small millet (<i>pennisetum typhoideum</i>).
KANS ...	...	A coarse deep-rooted grass weed (<i>saccharum spontaneum</i>).
KHARIF ...	...	The autumn harvest; crops sown at the beginning of the rains and reaped in October-December.
KODRA ...	...	A small millet (<i>paspalum scorbulatum</i>).
KURBI ...	...	Straw of juar (millet).
KUTCHA ...	...	Inferior or bad [literally, "not solid"].
LAKH ...	...	One hundred thousand.
MAHAJAN ...	...	Merchant, moneylender.
MALIK ...	...	Owner, proprietor.
MANGO... ..	...	An evergreen fruit tree (<i>mangifera indica</i>).
MARWARI ...	...	A banker, broker, merchant.
MAUND... ..	...	A weight of 82·28 lb. (<i>pucca maund</i>). Has different values for different commodities, and for the same commodity in different localities.

PADDY ...	...	... Rice (<i>oryza sativa</i>).
PALAS ...	...	... A moderate sized deciduous tree (<i>butea frondosa</i>).
PANCHAYAT ...	...	... Lit., a committee of five. Used to describe an association of any number of persons, instituted for objects of an administrative or judicial nature.
PATWARI ...	...	... A village accountant or registrar.
PUCCA ...	...	... Of good quality, up to standard, correct, substantial.
PURDAH ...	...	... A veil, screen; the practice of keeping women secluded.
RAB ...	...	... The practice of burning leaves, grass, sticks, etc., on land as a preparation for sowing.
RABARI ...	...	... A caste of herdsmen and milkmen.
RABI ...	...	... The spring harvest; crops sown in autumn and reaped at the end of the cold weather.
RAJI (RAGI) ...	...	... An inferior variety of millet (<i>eleusine coracana</i>).
RYOT ...	...	... A cultivator.
RYOTWARI ...	...	... A system of tenure under which the cultivator pays the revenue direct to Government.
SAL ...	...	... A large gregarious tree (<i>shorea robusta</i>).
SAMBA ...	...	... A superior kind of rice.
SAWAN ...	...	... A millet (<i>panicum frumentaceum</i>).
SENJI ...	...	... A fodder crop (<i>melilotus parviflora</i>).
SESAMUM ...	...	... An oil seed (<i>til</i>) (<i>sesamum indicum</i>).
SHAKKAR ...	...	... Sugar.
SORGHUM ...	...	... A genus of grasses, the most important of which is juar the great millet (<i>sorghum vulgare</i>).
SOWCAR ...	...	... A moneylender.
TACCAVI ...	...	... An advance made by Government to cultivators for agricultural purposes.
TAPIDAR ...	...	... A subordinate revenue official.
THANA ...	...	... A police station, a post.
TONGA A horse or bullock carriage.
ZAMINDAR A landowner, a peasant proprietor.

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